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# Electrical World

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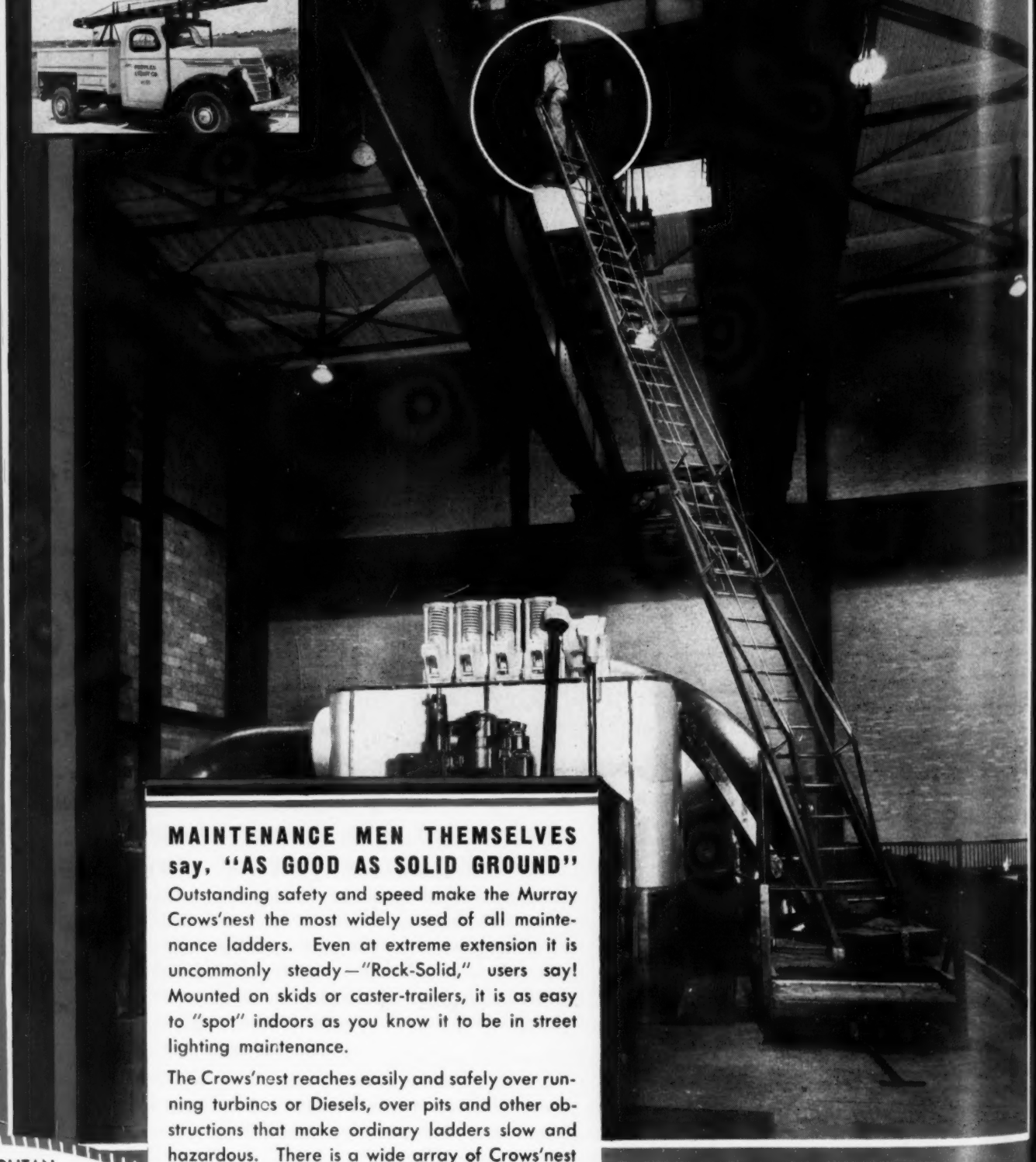

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# Electrical World

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ELECTRICAL WORLD Published weekly. Price 35 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to J. E. Blackburn, Jr., Director of Circulation. **Return Postage Guaranteed.** Subscription rates: In the United States, $6 a year, $9 for two years, $12 for three years. Canada $7 for one year, $11 for two years, $14 for three years (Canadian money at par). Pan-American countries $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in the U. S. A. Contents copyrighted, 1947, by McGraw-Hill Publishing Co., Inc. All Rights Reserved. Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

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Editorial and Executive Offices.....330 West 42nd St., New York 18, N. Y.
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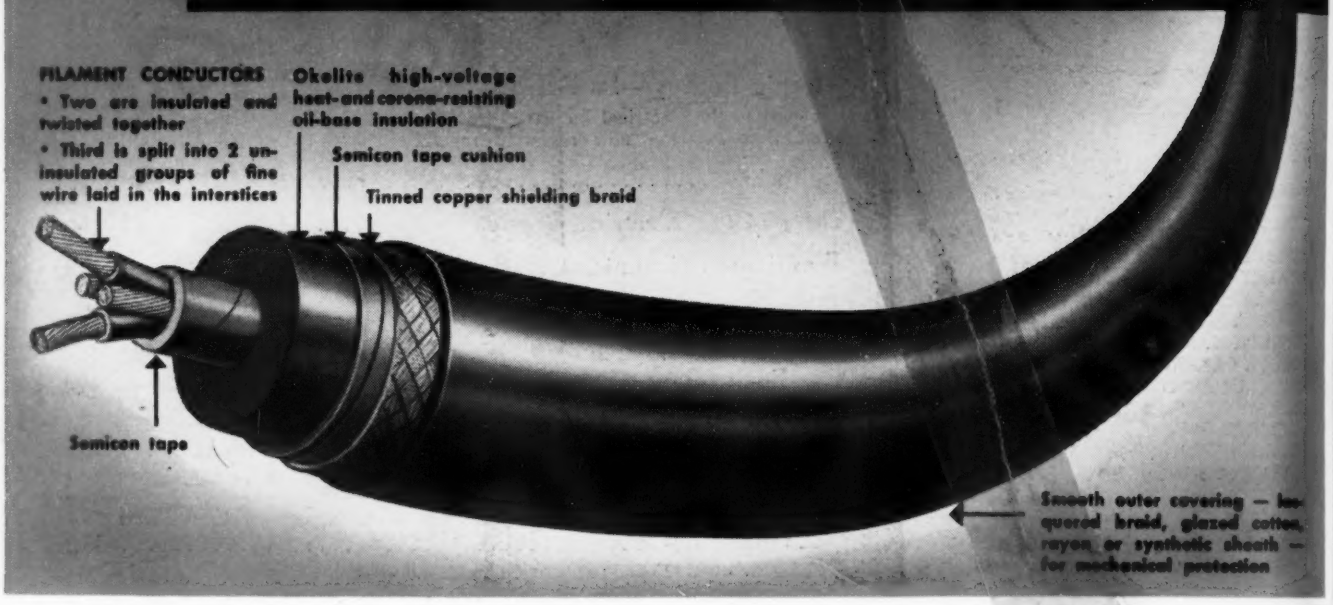
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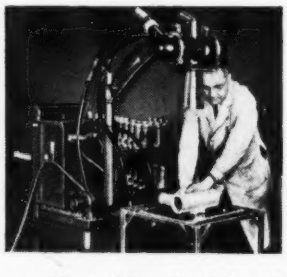

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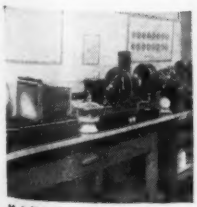

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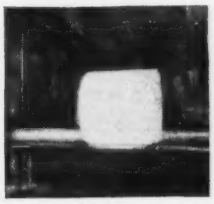

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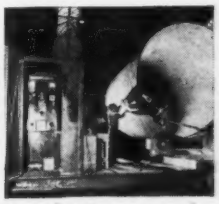

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# TAX REVISION...

## Can Make or Break American Business

IS THE American way of life—progress by private initiative—going to get a fair chance to demonstrate its superiority over all the challenging varieties of collectivism?

That's the real question before Congress as it confronts the long labor of remodeling the federal tax structure. What Congress does about taxes will come pretty close to making or breaking the U. S. A.

Today the tax colossus that sprawls across the national economy is unguided by any central nervous system. Its crushing weight comes down first here, then there, as the giant wobbles around, unguided by any central purpose except to grab as much as it can.

The central purpose of a tax system is simple. It should raise the necessary revenue without placing unnecessary fetters on enterprise.

As recently as 1929 federal taxes took only one dollar out of every twenty of national income. A loose-jointed and inconsistent tax structure was a nuisance then. But it wasn't serious.

Today the federal tax burden is the dominant element in the nation's economy.

Even if Congress succeeds in cutting $6 billions out of President Truman's $37.5 billion budget, federal taxes still will take about one dollar out of every five of the national income. And few Congressmen are hopeful enough to think that they can get the tax load below $25 billion for any year that is in sight.

### Drastic Budget Cuts Required

Indeed, to get the tax load down to $25 billion, Congress will have to stop treating expenditures, like those for military purposes and veterans, as politically sacrosanct. Congress must scrutinize *every* item in the budget. Economy must go along with tax cutting or we shall end in bankruptcy.

Suppose that expenditures are slashed to the bone. Our taxes *still* will be so heavy that the *way* they are loaded on the nation's back will make a big difference in how well the nation gets along. That's something which the postwar boom has tended to obscure. It will become much clearer as this boom wears off. Then a remodeling of the federal tax system to remove its manifold obstructions to private enterprise will be of transcendent and obvious importance to everybody.

### Tax Experts Agree

The remodeling will require political courage plus tax wisdom. Congress must supply its own political courage. But it can lean on tax experts for tax wisdom. Fortunately, tax experts now agree on the necessary reforms—especially on those that will remove obstructions to business. How well the tax experts agree is shown in the charts on the next page, summarizing answers to a questionnaire on possible federal tax reforms. The questions were asked by the Department of Economics of the McGraw-Hill Publishing Company. The answers came from a broad cross-section of tax experts, including the authors of a considerable crop of books on postwar federal taxes and what to do about them.

The experts agree (see the charts) that double taxation of corporate dividends should stop.

They agree that the tax rate on corporate income (now 38 percent) should be reduced as rapidly as possible to the initial rate on individual income (now 20 percent).

And they agree overwhelmingly that it is desirable to let net losses be subtracted from net profits over a 5-to-6-year period in computing business income for tax purposes.

All three changes would stimulate corporate initiative and hence make jobs. Averaging business incomes would make new ventures attractive even though these ventures *might* result in early losses. Reduction of the corporate income tax would have the same effect. So, too, would the elimination of that highly discriminatory provision whereby corporate dividends are taxed first as corporate profits, and again when received as income by individuals.

### Penalties on Incentives

Beyond these changes, there must be an end to tax penalties on *individual* initiative. Consider the enterprising business man whose income fluctuates markedly from year to year. Because of his enterprise he may pay, on the same income, twice as much federal income tax as the man who plays it safe for a steady income. That's because he can't average his personal income over several years for tax purposes. He can count on heavy taxation of his good-year profits with no chance for offsetting against them his bad-year losses. It is a case of heads you lose, tails the tax collector wins. Eighty-six percent of the experts agree that an income-averaging allowance for individuals is desirable.

Three-quarters of them also agree that tax rates at the top end of the individual income scale (now running up almost to 90 percent) should come down. In my judgment, the total tax should not amount to more than 50 percent to encourage business men to venture for high stakes.

Advocating tax relief for men in the higher income brackets—and particularly for management men—has been considered political suicide for more than a decade. Some members of Congress still hold that view. A Democratic Congressman from Michigan told an Illinois colleague who advocated cutting upper bracket taxes, "If you put that idea forward at home, you won't come back."

The Congressman has an even better chance of not going back if our economy bogs down. One of the best ways to bog it down is to keep the taxes that destroy business incentives and block enterprise—for example, the confiscatory rates which drive the people in the high brackets away from risk-taking.

To give the American system of individual enterprise a fair chance was clearly the mandate of November's election. To give it that chance, enterprising business men must have a chance to make large rewards—as well as the always-present chance to lose their shirts. Under present tax rates, they don't get a break.

Prevailing federal taxation throttles bold business enterprise in other ways. It fails, for example, to encourage research and rapid industrial modernization. It tends to siphon investment away from private enterprise, driving it into tax exempt state and local securities. (The experts agree almost to a man that such tax exemption must be eliminated.) The list of obstacles could be amplified.

### Hit-and-Run Revision Disastrous

Most of the reforms needed to prevent the federal tax system from smothering enterprise would lower federal revenues, at least temporarily. Elimination of the double taxation of corporate dividends might lop off $800 million. Dropping the corporate income tax from 38 percent to 20 percent might cut away as much as $4 billion.

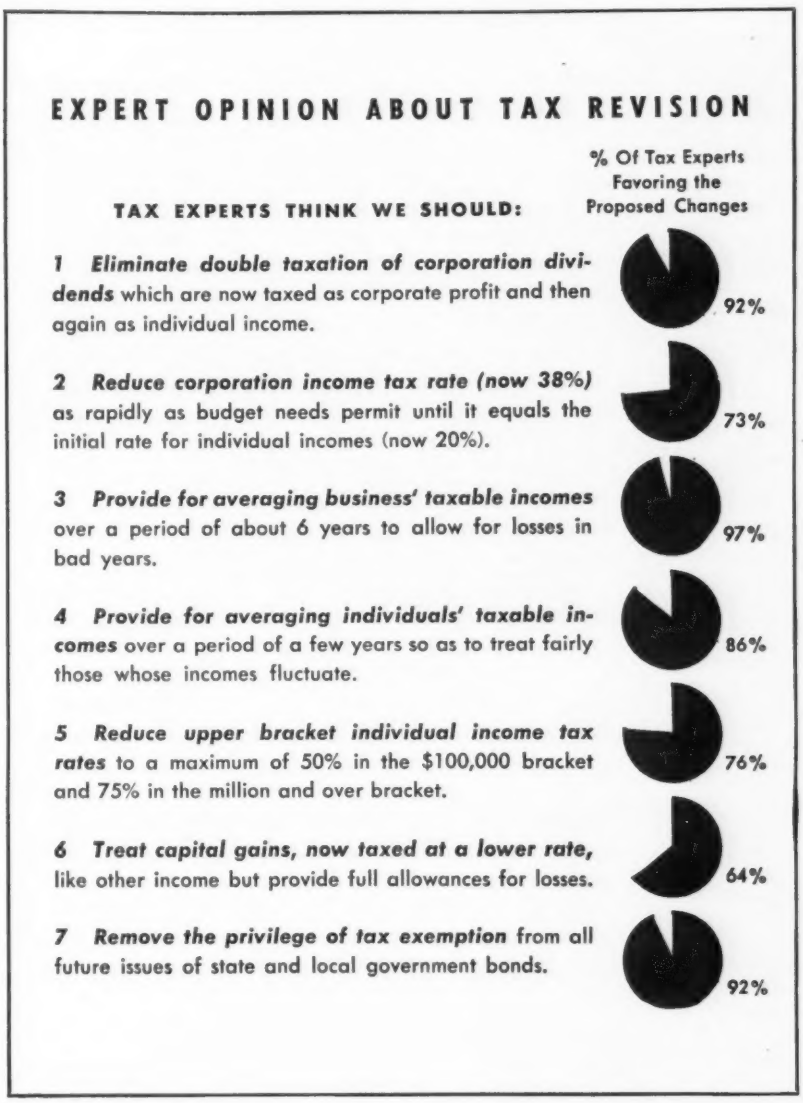
Because we can not avoid enormous federal expenses in the years immediately ahead, all badly needed reforms of the type to which this article is confined obviously can't be made at once. Also there are other tax reforms bearing on consumption which obviously should be weighted in an over-all program of tax revision.

But this is equally obvious: We should have a general design for tax revision which would line up all the necessary steps. Then we could get ahead with tax reductions as rapidly—and as sensibly—as revenue requirements and political courage would permit. Tax cutting may come piece-meal, but tax planning must not.

Through such a design we might discover that some decidedly beneficial improvements in the federal tax structure can be made at relatively slight cost. But today there's no way to be sure. No one in Washington with access to the information has even undertaken to make the necessary estimate.

Instead, federal tax revision continues to be a hit-and-run business—and a short-run political business. Take, for example, the proposal of a 20 percent tax reduction across the boards. There are virtues in such a proposal. But how they stack up beside many other extremely urgent needs for tax reform remains a mystery.

Congress must dispel such mysteries. Only in that way will it do the job of converting our present jerry-built tax structure into a moderately safe abode for the American system of private initiative, sparked by adequate incentives.


EXPERT OPINION ABOUT TAX REVISION
% Of Tax Experts Favoring the Proposed Changes
TAX EXPERTS THINK WE SHOULD:
1 Eliminate double taxation of corporation dividends which are now taxed as corporate profit and then again as individual income.
92%
2 Reduce corporation income tax rate (now 38%) as rapidly as budget needs permit until it equals the initial rate for individual incomes (now 20%).
73%
3 Provide for averaging business' taxable incomes over a period of about 6 years to allow for losses in bad years.
97%
4 Provide for averaging individuals' taxable incomes over a period of a few years so as to treat fairly those whose incomes fluctuate.
86%
5 Reduce upper bracket individual income tax rates to a maximum of 50% in the $100,000 bracket and 75% in the million and over bracket.
76%
6 Treat capital gains, now taxed at a lower rate, like other income but provide full allowances for losses.
64%
7 Remove the privilege of tax exemption from all future issues of state and local government bonds.
92%

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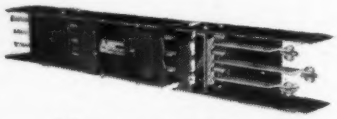

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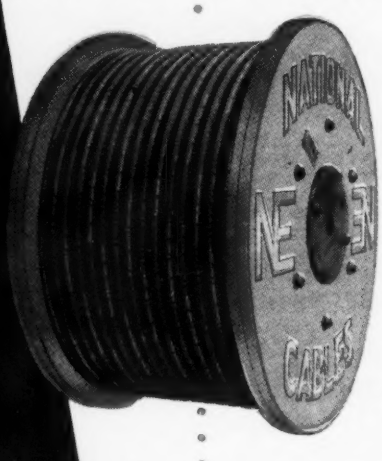

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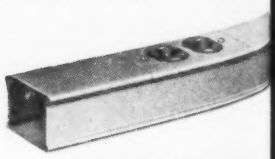

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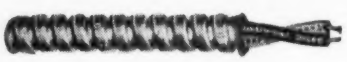

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Electrical World

MARCH 15, 1947

# It Will Take Time

THE ATOMIC ERA has begun. Man has an energy source a thousand times as potent as any he has known. That he will stop short of complete development of the potential uses of the atom is unthinkable—man never relinquished anything discovered and controlled.

No very clear path to use of atomic energy for power generation is yet to be seen. We see the flesh but not the vision. We look at the "horseless carriage" of 1900, and fail to see the six-lane highway its descendants require.

Some predict power in commercial quantities from experimental atomic piles in five years. Others think it will take longer. An earnest student of power-development history probably would suggest that full realization will be measured better in terms of half a century. Scientists have merely scratched the surface of nuclear physics. A power unit designed on present nuclear information stands a good chance of being obsoleted by further advance in science before its construction can be completed.

None the less, the research is planned, the pathway is delineated and first steps are being taken toward practical realization of an atomic power plant. Elsewhere in this issue is a roundup of present knowledge of plans and implementations, based on an intensive study by Robert Colborn of ELECTRICAL WORLD's Washington Bureau.

Nothing in this report indicates that the 13 million kilowatts now on order should be cancelled in favor of atomic power. Every indicator points to long years before any manufacturer will have a salable power unit. Even then, under the law, it could only be sold to the Atomic Energy Commission or a licensee.

Physicists as yet barely have penetrated the basic concept of converting mass to energy. Most funds go into laboratories and facilities for studying atomic nuclei, not directly for development of apparatus to employ uranium fission. Plainly, the physicists have much more work to do before the development engineer can begin to show results. Possibilities for the future are much wider in scope than simply burning up the world supply of U-235.

Were U-235 the only prospective fuel, a principal function of any commission governing atomic energy would be exploration for further supplies of uranium whence the fuel component could be extracted. Such obviously is not the case. Research is to be directed at manufacture of other fissionable fuels on an economic basis from more prolific ores. Another path obviously will lead to, and perhaps through, the hydrogen-helium atomic reaction. While this last seems a hard nut to crack, the greatest single hurdle was overcome on December 2, 1942, when the first controlled nuclear reaction was created.

The pattern of development is so broad that the world can only await some further mapping of the course. There seems no need to sell short known means of power-making until the researchers uncover more definite patterns—unless, of course, someone uses knowledge already gained to end this civilization forever.

# ★ ★ NEWS OF THE

## Copper Scarcity and Canadian Industry Get NEMA Attention

**Members Advised to Press Congress to Take Action Which Will Bring Industry More Copper—CEMA President Outlines Outlook of Electrical Manufacturing Industry in Canada**

LAST MINUTE DEVELOPMENTS in the copper situation and an outline of future prospects of the electrical manufacturing industry in Canada were brought to the attention of more than 500 assembled National Electrical Manufacturers Association members last week in Chicago.

Frank C. Jones, president, Okonite Co., in discussing copper stated that "if quick action is not obtained in Washington we are faced with a 50 percent shortage." Jones suggested that each individual member contact his Congressman immediately to obtain action on Congressman Robert A. Grant's bill (HR2323).

J. S. Keenan, president, Canadian Electrical Manufacturers Association, stated the present outlook for the electrical manufacturing industry in Canada is generally favorable but faced with keen competition among domestic producers and from abroad. Canadian electrical manufacturers, he added, have increased investments in plant and equipment by $28,000,000 in the past two years and have increased industrial capacity to about three times its pre-war volume.

While he described Canada as a difficult market for the selling and distribution of electrical appliances, because of the fact that customers were sparsely located over many miles of electric distribution lines, he pointed out that in 1939 Canada imported, principally from the United States, more than $13 million worth of electrical parts for further processing by Canadian industry. In the same year, he said, Canada exported $6 million in finished electrical goods, chiefly to British markets.

As one favorable factor in developing the electrical market in Canada, he cited an abundance of power at reasonable rates. Canada's 2 million domestic users of electricity, he said, consume an average of 1,600 kw.-hr. per customer per year. This compares to a 1946 annual average of 1,327 kw.-hr. per customer in the United States. In the City of Winnipeg, he said, average residential consumption runs as high as 4,200 kw.-hr. per year.

Approximately 70 percent of the homes in Canada are wired, making a total of 2 million, he said. In the rural field, however, he said that only 140,000, or 20 percent of the farms are wired. This is a live subject, but a difficult problem in Canada, he continued, because of the wide expanse and comparatively small population of the country. In some parts of the prairie provinces, the farms are large and average only slightly more than one customer per mile of distribution line. Present plans call for the wiring of 75,000 additional farms during the next five years.

Speaking of the world-wide shortage of copper, Mr. Keenan said that Canada produced double its own requirements of copper but was using it sparingly to help out the rest of the world.

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### Committee Approves Copper Relief Bill

**Industrial pressure on Congress to "do something about the copper tariff" has resulted in a new bill which would suspend the 4-cent excise on the metal until March 31, 1950. The idea has the approval of the House Ways and Means Committee.**

**The new bill stems from agreement reached last week during three closed sessions of the House committee. Two bills on tariff changes for copper imports had been introduced previously. The first, by James T. Patterson, Republican Representative from Connecticut's brass mill district, would have repealed the excise tax. The second, by Rep. Robert A. Grant, Indiana Republican, would have suspended the tariff for three years, and it was this proposal that prevailed, with Patterson putting his name on it.**

**The bill is slated for a long and heavy fight, mainly in the Senate. A poll of Western Senators discloses that the consensus would allow only a one-year waiver of the duty, and that to be applied only on certain amounts of foreign metal.**

**Passage in the House is far from a cinch. Veteran Rep. John R. Murdock, Arizona Democrat, talking for a large number of marginal miners in his state, does not favor any tariff reduction and will fight the proposal.**

### Debate on AEC Members by Senate May Last Week

Senate leaders expect that debate on the nomination of David E. Lilienthal as chairman of the Atomic Energy Commission may continue for another week, followed by "certain" confirmation. With 46 Senators indicating their approval of the appointment, as against 24 opposed, Lilienthal backers predicted they would confirm all the AEC appointments.

The Senate debate started shortly after members of the Atomic Energy Committee approved the Lilienthal appointment by an 8 to 1 vote, Senator John W. Bricker, Ohio Republican, rendering the lone opposition ballot. Senators Bricker and Edwin C. Johnson, Colorado Democrat, voted against the nominations of Sumner T. Pike as a member of the commission and Carroll Wilson as AEC general manager. Other AEC appointees—Lewis L. Strauss, William W. Waymack and Robert F. Bacher—were approved unanimously.

# Supreme Court Upholds Right of Foremen to Form Unions

**Votes 5 to 4 to Uphold NLRB Order Directing Packard Motor Car Co. to Bargain with Foremen — 2 Utilities Involved in Similar Controversies Believe Decision not Final for Them**

THOUGH the Supreme Court this week upheld the unionization rights of foremen under terms of the National Labor Relations "Wagner" Act, there are mounting indications that Congress intends to have the final say in the matter.

The high court, by a 5-4 majority, upheld a National Labor Relations Board order directing the Packard Motor Car Co. to bargain collectively with 1,100 foremen who organized a unit of the Independent Foremen's Association of America. Following the decision, Sen. Joseph H. Ball, Minnesota Republican, and Rep. Fred A. Hartley, New Jersey Republican and chairman of the House Labor Committee, announced that they would push Wagner Act amendments eliminating supervisory personnel from the Act's coverage.

Officials of two utilities involved in controversies with foremen's unions—Potomac Electric Power Co. and Virginia Electric & Power Co.—expressed opinions that the Packard decision might have little important bearing upon their own labor relations activities. Other foremen's cases yet to be decided by the courts, they indicated, probably would prove more pertinent.

The majority decision in the Packard case specifically upheld the right of foremen, in general, to organize with Wagner Act protection. The present language of the Act, the court held, leaves "no room" for an interpretation denying "the organizational privilege" of supervisory employees.

On the other hand, the majority made it clear that it was up to NLRB to "determine appropriate units" for bargaining under the Act, with the courts having authority only to review the supporting evidence considered by the Board in making its findings.

The evidence in the Packard case showed that the foremen constituted "an appropriate unit by themselves," the court decided. And, "while foremen included in this unit have different degrees of responsibility and work at different levels of authority, they have such a common relationship to the enterprise and to other levels of workmen that inclusion of all such grades of foremen in a single unit is appropriate."

Thus the court left open a question as to possible future decisions in controversies over the determination by NLRB of "suitable units." The majority opinion underlined two special conditions of the Packard case which might have bearing on any future decisions: (1) The function of the Packard foremen "is typical of the duties of foremen in mass production industry generally," with close relationship to rank-and-file workers. (2) The Packard supervisors organized as a unit of "an unaffiliated organization which represents supervisory employees exclusively."

A dissenting opinion was written by Justice Douglas, with Chief Justice Vinson and Justice Burton concurring. Justice Frankfurter agreed with this dissent in part. Principal contention of the Douglas opinion was that Congress did not intend that foremen be included in coverage of the Act and that the courts should not uphold foremen's unions until, and if, the Congress sanctioned them.

J. H. Ferry, vice-president and general manager of Potomac Electric Power Co., advised that his company as yet had received no further orders from NLRB to bargain with the independent foremen's union which brought unfair labor practice charges against PEPCO. He declined to comment on the company's probable action if such an order were forthcoming but pointed out that PEPCO's dispute with the union was based on "different factors" than those involved in the Packard case.

"Apparently, the Packard foremen are engaged in production line operations, and there is no clear definition of their authority as management representatives," he said. "Our foremen are very definitely a part of our management."

Virginia Electric & Power Co. officials said they would continue their contract negotiations with an International Brotherhood of Electrical Workers unit representing 180 VEPCO foremen. The company agreed last October to recognize this unit for a period of one year while awaiting settlement by the courts of the foremen issue.

"We are by no means satisfied that the Packard decision settled this issue

**BEYOND PICKET LINES—A helicopter brings in a load of raw materials for the New Bedford, Mass., plant of the Cornell-Dubilier Electric Corp. where members of the Teamsters Union, A.F.L., are on strike. Members of the International Brotherhood of Electrical Workers, A.F.L., have stayed at work at the plant**

as far as our case is concerned," said T. J. Moore, vice-president and general counsel. "Though the Supreme Court made no such statement, the lower courts previously agreed to uphold NLRB only because an independent union was involved. We are opposed to our foremen's organization because it is placing them in the same union with our rank-and-file employees and will involve a conflict of loyalties between the interests of that union and the company."

Mr. Moore indicated that the case brought by NLRB against the Jones & Laughlin Steel Corp. would present a more appropriate test of the issues involved in the VEPCO-I.B.E.W. dispute. The J. & L. case, now in the lower courts, arose when NLRB ordered the steel company to bargain with the United Clerical, Technical and Supervisory Employees Union on behalf of supervisors at four captive coal mines.

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## Allocations of Phenolics by CPA to End March 31

Government allocation of phenolic resin molding compound for use in scarce electric equipment will terminate on March 31, at the request of both producers and users of the material.

After conferences last week with producers of the compound and manufacturers of wiring devices, the Civilian Production Administration decided to drop the allocations which have been made since last September under Schedule 121 of Chemicals Order M-300. But the step was taken only after compound producers assured CPA and the Office of the Housing Expediter that they would voluntarily allocate sufficient supplies to meet minimum requirements for wiring devices for the remainder of 1947.

Wiring equipment manufacturers recommended this procedure on the ground that producers of the plastic material could supply their demands for 1947. They estimated these as 64,100,000 toggle switches, 66,100,000 convenience outlets, and 141,200,000 medium screw base sockets, lampholders, and lamp receptacles. Requirements for wall plates will match those for toggle switches and convenience outlets. In addition, the industry accumulated during 1946 backlogged demands for some 9,300,000 toggle switches and 14,800,000 convenience outlets.

Industry spokesmen estimated their monthly requirements for molding compound at 1,800,000 lb. The anticipated 1947 output is 153,000,000 lb. CPA had previously allotted the industry 1,283,100 lb. for March.

**FAREWELL—Allen G. Jones, left, Pacific District manager of General Electric's Apparatus Department, bids an official farewell to Walter C. Smith, engineering consultant for the company, who has retired after 42 years' service. A winner of the Charles E. Coffin Award, Smith has been a vice-president of the American Institute of Electrical Engineers**

## Supreme Court Returns Arkansas Case to FPC

The Supreme Court this week sent the Arkansas Power & Light Co. case back to the Federal Power Commission for settlement of a federal-vs.-state controversy over the company's accounting practices.

The case evolved from differences in accounting regulations of FPC and the Arkansas Public Service Commission, which the company claimed had forced it to keep two sets of records in order to comply with all regulations.

On these grounds A.P.&L. sought a declaratory judgment as to which agency had final jurisdiction over its books. Such a judgment was refused by a Federal District court, but this initial decision was set aside by the District of Columbia Court of Appeals.

In a per curiam decision the Supreme Court reversed the judgment of the appellate tribunal on the grounds that "respondent has failed to exhaust its administrative remedies." Thus, FPC was sustained in its contentions that, before seeking judicial relief, the company and the Arkansas commission were required to seek an administrative settlement of the controversy under the review procedures provided in the Federal Power Act.

## Union Leader Dissatisfied With Duquesne Settlement

**Mueller Asserts Arbitration Pact Failed to Adjust Inequities and Laid Groundwork for More Trouble**

The award made by the arbitration board which resolved differences between the Duquesne Light Co. and the independent union representing its employees lays the groundwork for future labor disturbances on that system, according to George L. Mueller, labor member of the arbitration panel.

In an opinion issued with the award last month, Mueller, who is also president of the independent union, explained some of his dissents from the 58 awards. In it, he asserted:

"Definitely let it be noted that the impartial chairman (George E. Strong) and the industry member (Maurice Scharff) of the board have been guilty of erecting or laying the basis for more labor disturbances that may occur among the employees in the future."

In their opinions, both Strong and Scharff also expressed scepticism regarding future possibilities of peace between Duquesne and its affiliated companies and the independent union representing employees of all of them.

"One can see," Mueller said, "why the statement has been issued by the union that 'now it will be necessary for the union to attempt to undo the damage caused through arbitration.'

"Since the board did not grant any of the major requests of the union, nor adjust the gross inequities now in existence that have caused work stoppages in the past, the company member and the chairman, each has clearly failed in his duty as an arbitrator in settling a serious dispute."

### *Union Leader Opposes Strikes*

Mueller denied repeatedly that the independent union wants or believes in strikes.

"The union, of course," Mueller declared, "as indicated earlier in this opinion, does not manifest a desire to strike at any time."

Commenting on numerous specific union requests which were disallowed, Mueller repeatedly referred to evidence favoring the union's position which it introduced in the hearings. Often, these references were to contracts effective elsewhere with electric utilities.

In particular, Mueller assailed the failure to grant a union shop, holding it necessary to the union if it is to be able to discipline its members. The wage awards, which ranged from 5 to 18 cents hourly, Mueller described as "ridiculous."

# Manufacturers Offering High Intensity Lights for Airports

**Sylvania and American Gas Accumulator Co. Likely to Get Contracts for Approach Lights as Result of Tests Made at Newark — Line Material and Westinghouse in Market**

LATEST COMPETITORS for the new high intensity runway airport approach light market, which is expected to total millions of dollars annually, are the American Gas Accumulator Co., Elizabeth, N. J., and Sylvania Electric Products Co., Salem, Mass. Both are in line for contracts with the Civil Aeronautics Administration as a result of tests of their products now nearing completion at Newark, N. J., Airport, by an aviation joint committee.

J. B. Bartow, head of the Airport Lighting Section of Line Material Co., East Stroudsburg, Pa., sold the Army and Navy some 40,000 Bartow units, of an earlier design, during the war, and is making changes for further tests, expecting to enter the civilian market.

Westinghouse Electric Corp. has a super-high intensity condenser discharge gas tube light with an intensity up to 5 billion candlepower under development. The company makes no commitments but hopes the light will penetrate several hundred feet of fog. Duration of the intermittent flash is short, and some experts are not sure whether the eye can register its full power. These lights will flash in progression along the approach line toward the threshold of the runway.

Airports have had border lights to define runways for years. Approach lights in one or two rows, on the line of the runway extended, outside the field, are a relatively new development. They guide the pilot in his letdown and enable him to abandon instruments and come in on contact more quickly.

At present CAA has single neon tube lights for approach, but pilots have pronounced them unsatisfactory, especially in low daytime visibility, when the strongest light is needed.

The new high intensity A.G.A. lights had initial tests during recent months at the landing aids experiment station, jointly operated at fogbound Arcata, Calif., by the Army and Navy, with CAA more recently participating. United Air Lines had the operating contract until Trans-Ocean Airlines took it last month. The Newark committee chose A.G.A. equipment as a result of Arcata's work, added Sylvania, and is checking Arcata's data and adding some of its own.

Both Bartow and A.G.A. are high power incandescents. Sylvania is four neon bars combined with a condenser discharge tube of smaller power than the Westinghouse tube. The row of A.G.A. lights burn steady; Sylvania tubes burn steady, with the discharge tubes flashing in progression along the row.

Focusing approach lights on incoming planes without creating glare is a difficult problem. Bartow thinks glare is bad and has always used a narrow beam so that only three or four lights are full in the pilot's eyes at one time. But he is now widening his beam a little and is using multiple rows to get a wider beam effect. A.G.A. contends, with some confirmation by both test stations, that glare is not serious—because the pilot, in last stages of approach, needs see only lights, which give him a complete reference—and uses wide beam.

Experts are divided on the relative merits of one or two rows of approach lights. Right now Newark thinks one row is best.

The Newark installation of A.G.A. lights is costing $39,317; Sylvania, $54,521. Service construction will cost more. Replacement of A.G.A. 5,000-watt bulbs is frequent and expensive. A 3,000-ft. row of 60 or 70 Westinghouse type condenser discharge lights is estimated to cost more than $100,000.

Experts say that, by Allard's law, light penetration of fog depends upon intensity alone. The wave lengths of all light colors are shorter than the diameter of a mist globule; therefore, all colors are intercepted.

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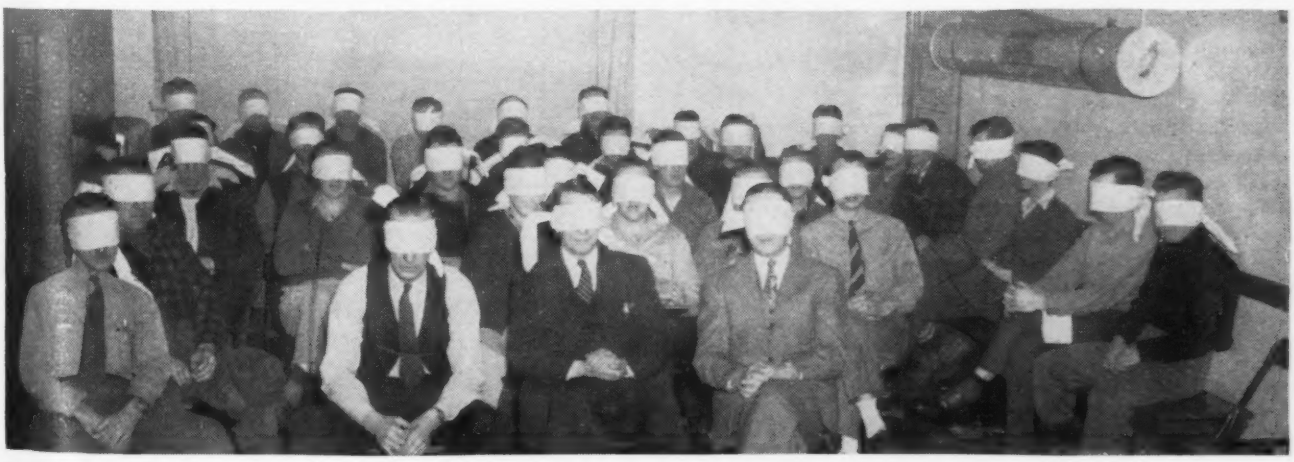
## Asks Permit for Plant

South Carolina Electric & Gas Co. is planning a new hydro plant on the Saluda River to be coordinated with its other hydro projects near Columbia, S. C. In an application to the Federal Power Commission for a preliminary permit, the company stated that it would build a concrete dam and a powerhouse equipped with three generating units of 20,000-kw. total capacity. The purpose of the project is to develop as much fall as practicable in the river below the company's Lake Murray plant.



LIKE BEING BLIND—To emphasize the seriousness of eye injuries, T. L. Paden, Pennsylvania Power Co., had a group of company employees wear blindfolds during a recent safety talk on eye injuries which he made at Greenville, Pa.

## Soft Coal Strike May Be Called July 1 or Earlier

**Supreme Court Decision Failed to Determine What Will Happen When Operators Take Back Mines**

Another soft coal strike is in prospect on July 1, maybe earlier. That is today's outlook in the light of the Supreme Court decision against John L. Lewis, the status of coal industry negotiations, and Congressional thinking. All industry should at least plan for it, even though it may not materialize.

By a narrow 5-4 decision, the Supreme Court upheld the government's right to enjoin Lewis from calling a strike of his United Mine Workers in the soft coal mines, but only because the miners were considered government employees under the government operation of the soft coal mines.

This narrow application of the court's decision would leave the coal operators helpless when government authority to operate the seized mines ends June 30—unless a settlement is made with Lewis in the meantime or Congress enacts legislation to cope with the situation. A strike could come sooner if the government turned the mines back to their owners.

### *Agreement Will Avert Strike*

Only an agreement between Lewis and the coal operators can be considered insurance against another strike in the view of Washington observers.

Congress is considering legislation to cope with strikes causing a national crisis, such as continuing government's war-time seizure powers or amending the Norris-LaGuardia Act to grant government the right to enjoin a strike without seizure where the country's interest is seriously affected.

While such law might limit the duration of another coal strike, it is not likely to prevent one. It is known that the government is anxious to get out of the coal mining business and may unload the mines June 30 even if it had power to retain control. If it were given only injunctive power, it might not be inclined to exercise it until a strike continued to the point where the depletion of coal stocks developed a crisis.

Congress is not likely to outlaw strikes in basic industries or public utilities, nor is it seriously considering compulsory arbitration.

Continuation of coal production on July 1, then, would appear to rest largely on an agreement between Lewis and the operators. And this is not likely until after Congress makes up its mind what it is going to do about union welfare funds and the five-cents-a-ton royalty on coal production, against which Southern coal operators rebel; industry-wide bargaining; and the unionization of foremen.

### Power Program Digest

**Four pages of information on the Reclamation Bureau's $800 million power program for the fiscal years 1947-1952, including a two-page map of transmission lines and power plants, will appear in *Electrical World's* March 22 issue. Complete tables of proposed transmission lines and power plants will accompany the map.**

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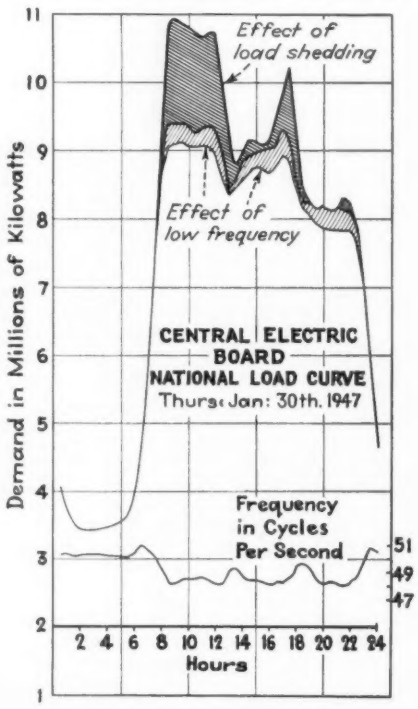
## England Drops Load, Cuts Voltage to Provide Power

Even before the recent coal shortage, England was having great difficulty in supplying all the electricity demanded. The Central Electricity Board, which has a nationwide grid extending into Scotland, adopted two methods of "rationing" power that would cause the least hardship to the people and industries.

The one method was shedding (dropping) load in areas where the demand was too great. Local utility authorities were told how much load they had to shed but were allowed to use their own judgment as to what customers were to be affected.

The second method was to allow the frequency of the normal 230-volt, 50-cycle current to fall from 50 to as low as 48.4 cycles over a considerable period of the day. In this way the demand could be cut about 5 percent.




It was impossible to reduce frequency to a lower point because (1) at a lower frequency certain generating plant auxiliaries would fail and aggravate the deficiency, (2) dangerous results might ensue as the resonant frequencies of much industrial equipment were approached, (3) signals on the Southern Railway would fail to operate properly.

The accompanying chart records the 24-hour demand and supply for the peak day, January 30. The top of the curve shows the total demand that existed and the bottom curve shows the power actually delivered. The shaded portion indicates the load reduction obtained by supplying current of lower frequency, the solid portion load that was shed.

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## Denver Taxpayers Vote Utility 20-Year Franchise

A new 20-year franchise for the Public Service Co. of Colorado has been approved 49,746 to 5,960 by taxpaying electors in Denver at a special election.

Terms of the contract include an increase in the annual $60,000 franchise tax to approximately $375,000 (based on 3 percent of gross revenue in Denver), a rate reduction that will average 13 percent per customer, and installation at company expense of a $1,000,000 street lighting system, together with a cost cut of 9.8 percent on the city's illumination bill.

The company agrees also to purchase and distribute all energy from the Colorado-Big Thompson project if such power can be bought at the same, or lower price than it can be produced by the utility's facilities, and to pass on any savings to customers (latest figures indicate Colorado-Big Thompson electricity will be more expensive than company-generated energy).

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## Commission Will Pay Bill

The entire $200,000,000 estimated expense of converting Southern Ontario's 25-cycle power to 60 cycles will be borne by the Ontario Hydro-Electric Commission, Commissioner W. Ross Strike told Ontario members of the Canadian Manufacturers' Association last week. The conversion plan, however, still awaits approval of various municipal electric associations.

# UN Group Suggests Greece Develop Hydro Resources

**Projects with 800,000-Kw. Capacity Proposed to Relieve Balkan Country Which Must Import All Fuels for Thermal Stations — International Loans of $100,000,000 Necessary**

FULL DEVELOPMENT of war-torn Greece's river resources, including construction of hydoelectric projects with a total capacity nearly equal to that of America's Boulder Dam plants, has been recomended by a United Nations investigating committee.

The group was sent to Greece last May by UN's food and agriculture organization and spent two to three months studying the stricken country's rehabilitation and development problems. A preliminary report of the mission's findings was presented to the food organization last fall. Details of the group's full recommendations have just been made available.

The mission was headed by Franklin S. Harris, president of the Utah State Agricultural College. Recommendations for the extensive water utilization program, which constitute a major portion of the report, were largely the work of William L. Newmeyer, chief of the Resources and Development Section of the Bureau of Reclamation.

This section of the report urges that Greece, with the guidance of a UN Advisory body, undertake flood control, drainage, and irrigation projects costing some $20,900,000 within the next five years, with plans for some $130,000,000 of additional development work later. These and other costs used were based on 1939 construction costs in U. S. dollars, and the report notes that present-day prices in Greece are estimated to be 180-200 percent of these amounts.

### *Neglectful in Developing Energy*

Accompanying these water control projects, the report adds, should be a "number of low-production-cost hydroelectric developments," which, when completed, could add generating capacity totaling some 800,000 kw. with an output of 5,000.000,000 kw.-hr. per year. However, "not all this development may be feasible."

Greece has done little so far in the way of developing energy from its river resources, the report says. Instead, "Greece today imports costly fuel for thermal plants because no coal, oil or gas fuel 'except an undetermined amount of lignite' has been found" within its borders.

Costs of the hydroelectric development program is estimated at $15,000,000 (at 1939 prices) during the first five years and an additional $85,000,000 during the succeeding 15 years. Sixteen major hydro projects are recommended, the largest to be three plants with a total capacity of 290,000 kw. on the Acheloos River in Epirus. Only three other plants of more than 100,000-kw. capacity are suggested, one on the Nestos River in Thrace and two on the Aliakmon River in Macedonia.

This and other portions of the mission's recommendations should be financed in part by international loans administered by a UN advisory mission, it is proposed. The report finds that "Greece will need an initial international loan for 1947-48 of at least $100,000.000 if she is to begin the reconstruction and development program recommended" and "subsequent loans" to carry the program forward on an expanding scale.

**UNDER THE SCHUYLKILL—To meet the demand for electricity in West Philadelphia, the Philadelphia Electric Co. is constructing a 1,070-ft. cable tunnel under the Schuylkill River at Christian Street. The tunnel will carry numerous transmission cables leading from the new Southwark station and will have a ventilating system to carry off the heat losses of the cable lines**

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## Anti-Public Power Laws Lose in Washington State

All bills attempting to curb public power which were submitted to the Washington state legislature have been killed.

Although ten such bills were acted upon by Senate and House public utilities committees, only one was brought out for consideration by the lawmakers and that was quickly killed when the House refused to consider it. That bill proposed suspension of P.U.D. eminent domain proceedings for the next two years while a commission studied all phases of the state power set-up.

A bill which would have required P.U.D.'s to get approval of the Department of Public Utilities for every purchase of more than $5,000 was killed by unanimous vote. Another bill, which would have created a bipartisan Public Utilities Commission, was recommended by the House Public Utilities Committee but failed to get out of the Rules Committee.

Other measures killed would have required public sale of P.U.D. bonds, prohibited a P.U.D. from disposing of any property inside or outside its boundaries to another P.U.D. without approval of the voters of such district, and allowed dissolution of a P.U.D. by vote at the next general election after 10 percent of the qualified voters of such district had petitioned.

## $5.6 Billion Columbia R. Development Plan Drawn

Comprehensive development of the Columbia River Basin, over a period of "many decades" and at a cost of approximately 5.6 billions, is contemplated in a Bureau of Reclamation report submitted to Congress this week. Completion of the entire program would add new hydroelectric generating installations with a total capacity of 10,500,000 kw. in the area.

The work described does not include "every possible water-use development," the report warns. Further investigations probably will reveal additional possibilities for worthy irrigation and multiple-purpose projects, it adds.

The report is one of a series on western river basins being prepared by the Bureau in cooperation with the Army's Engineers, Federal Power Commission, Department of Agriculture, and various Interior agencies. The report on Missouri River Basin development was approved by Congress last year. Another, on California's Central Valley, now is being prepared.

The proposed program for the Columbia Basin calls for flood control, irrigation, navigation, power, conservation, silt control and pollution-abatement projects by several federal agencies in Idaho, Montana, Oregon, Washington and Wyoming. Of the 238 projects covered by the report 47 already have been authorized for construction by the Reclamation Bureau, Office of Indian Affairs, and the War Department. Eleven of the unauthorized works are recommended for early construction by the Bureau.

These are: Payette unit of the Mountain Home Project, Cambridge Bench, Hayden Lake, Council, and Hornet Creek, all in Idaho; Bitterroot Valley, Montana; Canby, Vale-Bully Creek, and Crooked River, all in Oregon; Kennewick Division of the Yakima Project, Washington; and Upper Star Valley in Wyoming. Cost of the eleven is estimated at $179,572,000, of which water users are expected to return $27,714,000 and power users, $143,160,000. New hydroelectric capacity installed on these projects would amount to 177,000 kw.

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## Municipal System Sold

The sale of the Colby, Wis., electric distribution system to the Northern States Power Co. for $55,000 has been approved by the Wisconsin Public Service Commission. The city sold the system as it did not feel that it could afford the expenditures needed to assure proper service to all customers.

# SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

NORTH AMERICAN CO.'s proposal to pay a dividend on its common stock in common stock of Pacific Gas & Electric Co., at the rate of one share of Pacific Gas on each 100 shares of North American, has been approved. The dividend is payable April 1 on stock of record March 3. (Release No. 7218).

KENTUCKY UTILITIES CO. has obtained permission to issue and sell to eleven banks unsecured 2½ percent serial notes for $5,500,000. The money will be used to redeem the company's outstanding 4½ percent sinking fund mortgage bonds, due February 1, 1955. (Release No. 7232).

DALLAS POWER & LIGHT CO.'s proposed charter amendments have been approved. Among the changes to be made will be an increase of the authorized no-par common from 273,000 shares to 2,500,000 no-par shares. (Release No. 7256).

ARKANSAS-MISSOURI POWER CORP. has ceased to be a holding company and its registration is no longer in effect. (Release No. 7243).

# MEETINGS

**Pennsylvania Electric Association**—Meter Committee, Roosevelt Hotel, Pittsburgh, April 10-11. R. A. Black, chairman, West Penn Power Co., Connellsville, Pa.

**Previously Listed**

**Oklahoma Utilities Association**—Annual convention, Tulsa Hotel, Tulsa, Okla., March 20-21.

**Southeastern Electric Exchange**—Spring conference of the Engineering and Operation Section, Sheraton Bon Air Hotel, Augusta, Ga., March 20-21; Annual Conference, Vinoy Park Hotel, St. Petersburg, Fla., April 3-5; Home Service Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 13-14.

**Midwest Power Conference**—Palmer House, Chicago, March 31-April 2.

**Edison Electric Institute**—Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 31-April 3; Engineering Committees, Edgewater Beach Hotel, Chicago, April 28-30.

**National Association of Corrosion Engineers**—Annual Conference and Exhibition, Palmer House, Chicago, April 7-10.

**Northwest Electric Light & Power Association**—Engineering and Operation Section, Multnomah Hotel, Portland, Ore., April 9-11; Business Development Section, Olympic Hotel, Seattle, Wash., May 7-9.

**Electrochemical Society**—Spring Congress, Hotel Brown, Louisville, Ky., April 9-12.

**Missouri Valley Electric Association**—Engineering Conference, Hotel Continental, Kansas City, Mo., April 16-18.

**National Rural Electric Cooperative Association**—Annual Meeting, Davenport Hotel, Spokane, Wash., April 22-25.

**Pennsylvania Electric Association**—Systems Operation Committee, Hotel Statler, Buffalo 5, N. Y., April 24-25.

## Move Underway to Curtail Public Construction Waste

The House Public Works Committee and the Army's Engineers are moving to cut down waste and lost motion on public works construction. The present target is the flood of bills introduced annually ordering the Army to make preliminary surveys of proposed flood control, and rivers and harbors projects. In recent years the mere introduction of such a resolution has been tantamount to an automatic order that the survey be made, regardless of cost or practicability. Now, with a tremendous backlog of projects authorized and awaiting appropriation of funds, the House committee and the Engineers are cooperating to cut down on new surveys.

The House subcommittees on flood control and rivers and harbors have approved two resolutions sponsored by Chairman George A. Dondero, Michigan Republican. They establish committee policy on all future proposals for preliminary surveys.

One resolution specifies that each new proposal will be subjected to close scrutiny to determine the need for a survey, the probable cost, and the work to be accomplished. Each member of Congress seeking a new survey will be asked to appear before the committee and state his case. The Engineers will be asked to submit a cost estimate and other pertinent data, including any previous reports and the status of the work. The committee will withhold action on every request for at least 30 days in order to collect the preliminary information.

Dondero's second resolution was aimed at eliminating repetition. It provides that hereafter when the War Department has submitted an unfavorable report on any project, three years shall elapse before new survey.

The committee chairman sponsored the resolutions after a check showed that the Engineers now are faced with 1164 resolutions for preliminary surveys and that this type of work costs about $4,000,000 annually.

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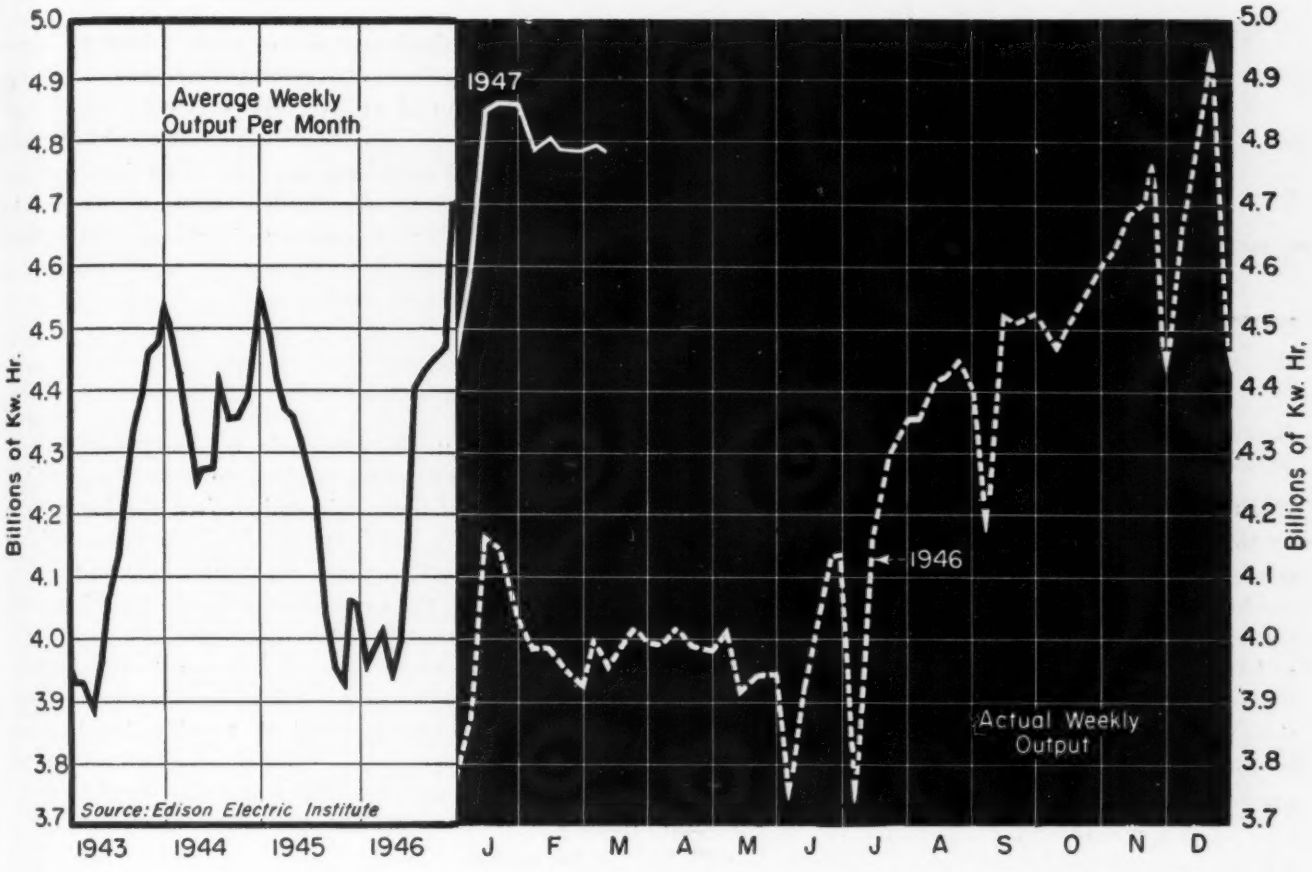
## Gardner Heads Utahans

Reid H. Gardner, president of the Southern Utah Power Co., has been elected president of the Utah Electric Service Association, until last year known as the Utah War Emergency Power Association.

Mayor J. Bracken Lee, Price, has been elected vice-president, and D. D. Moffat, Jr., research engineer, Utah Power & Light Co., secretary.




## Politically Run System Favored by Commission

The City Commissioners of Jacksonville, Fla., are not willing to have the utility system run by a non-political board and insulated from politics. Such was the decision given by Utilities Commissioner George A. Pierce recently to the Citizens Steering Committee, formed several months ago to make a study and recommendations of proposed needed public improvements in Jacksonville and Duval County.

The committee had notified the commissioners that it was not willing to approve the holding of a referendum among city voters for the issuance of certificates of indebtedness totaling about $15,000,000 for needed extensions and improvements to the city-owned electric system unless control passed to a non-political board.

The five-man commission accepted all the committee's recommendations save the one for the non-political board and took action to go ahead with plans to carry the bond issue to voters. However, the commission stated in a letter to the committee that "the City Commission believes that the administration of its public utilities should be by officials seleced by the people for that purpose in duly provided elections." It stated that the commission did not believe a board to be appointed by some authority other than the people should take over and perform the same duties now being performed by the publicly elected City Commission.

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## Anti-Cartel Suit Judgment Restrains Manufacturers

A consent judgment was entered this week in the U. S. District Court at New York in the anti-cartel suit against the Electrical Apparatus Export Association, General Electrical Co., International General Electric Co., Inc., Westinghouse Electric Corp. and Westinghouse Electric International Co.

The judgment dissolved the Export Association and enjoined defendants from agreeing to fix prices, allocate orders, divide sales territories, disclose bids, or recompense competitors on lost business. The original suit was filed in October, 1945.

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## 20-Year Franchise Given

In return for a 20-year franchise, Western Light & Telephone Co. has agreed to erect a $40,000 whiteway system in Dodge City, Kan., and to credit street lighting accounts with 2 percent of its gross domestic earnings in the city.

## Output Declines Slightly

The electric output curve turned downward during the week ended March 8, 1947, according to figures released by the Edison Electric Institute.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,786,552 000 kw.-hr., comparing with 4,797,099,000 kw.-hr. during the preceding week. During the week ended March 9, 1946, the amount of electrical energy distributed totaled 3,952,-539,000 kw.-hr., this year's figure representing an increase of 21.1 percent.

**Weekly Output, Millions Kw.-Hr.**

| 1947 | | 1946 | | 1945 | |
|---|---|---|---|---|---|
| Mar. 8 | 4,787 | Mar. 9 | 3,953 | Mar. 10 | 4,446 |
| Mar. 1 | 4,797 | Mar. 2 | 4,000 | Mar. 3 | 4,472 |
| Feb. 22 | 4,778 | Feb. 23 | 3,923 | Feb. 24 | 4,474 |
| Feb. 15 | 4,778 | Feb. 16 | 3,949 | Feb. 17 | 4,472 |
| Feb. 8 | 4,801 | Feb. 9 | 3,983 | Feb. 10 | 4,505 |
| Feb. 1 | 4,777 | Feb. 2 | 3,993 | Feb. 3 | 4,539 |
| Jan. 25 | 4,856 | Jan. 26 | 4,034 | Jan. 27 | 4,577 |
| Jan. 18 | 4,857 | Jan. 19 | 4,145 | Jan. 20 | 4,588 |
| Jan. 11 | 4,853 | Jan. 12 | 4,163 | Jan. 13 | 4,614 |
| Jan. 4 | 4,574 | Jan. 5 | 3,865 | Jan. 6 | 4,427 |
| 1946 | | 1945 | | 1944 | |
| Dec. 28 | 4,442 | Dec. 29 | 3,759 | Dec. 30 | 4,226 |
| Dec. 21 | 4,940 | Dec. 22 | 4,239 | Dec. 23 | 4,617 |

**Percent Change from Previous Year**

| | Mar. 8 | Mar. 1 | Feb. 22 |
|---|---|---|---|
| New England | +13.0 | +10.3 | +16.4 |
| Mid-Atlantic | +13.6 | +12.3 | +14.3 |
| Central Industrial | +23.8 | +24.4 | +30.8 |
| West Central | +18.1 | +16.5 | +17.0 |
| Southern States | +27.2 | +24.8 | +23.5 |
| Rocky Mountain | +13.0 | +10.5 | + 7.6 |
| Pacific Coast | +23.1 | +21.7 | +19.9 |
| Total United States | +21.1 | +19.9 | +21.8 |

# Electrical World
# OPINION

### *Nationalization in France and England*

NATIONALIZATION of electric service has now been accomplished in France and plans have been made for similar action by the British government. It is interesting to note some of the fundamental differences between government ownership and operation in these two places and the methods being followed in the United States.

Here the government has no announced nationalization program, but instead is gradually extending the scope of government operation of electrical service, occupying approximately one-fifth of the total at this time. While government spokesmen insist that there is a place for both public and private utility operation it cannot be denied that the same political schools that are responsible for French and British nationalization have similar hopes for America.

The essential difference between the two European programs and government operation in this country is that the nationalized utility services over there have to be operated as business enterprises and pay their way without government subsidy. Though their governments are strongly socialistic they are strict realists when it comes to nationalization and insist that none of the revenues paid into the government treasury by former private concerns shall be lost. Taxes will continue to be paid just as though the operation was private. The governments intend, as said the chancellor of the British Exchequer to a group of correspondents in Washington recently, that each industry taken over will continue paying into the treasury as much as it did prior to nationalization. How different from what happens over here when government acquires private property.

Likewise, the foreign programs are not founded on subsidies. If expenses are more than income then the consumers shall have to pay more. France, for instance, is reported to have raised electric rates substantially but a month after taking over the service. Again, how different from our procedure.

In both France and England government took the position that faster expansion of electric service was necessary than private industry had demonstrated it could achieve. With the United States leading the world in power consumption such an indictment of the power industry here could make little progress. France and England experienced power shortage situations during the war. There were none here.

Nationalization of utility services is not new abroad and it may bring about an expansion quicker than otherwise would have been possible. That it will bring more economical service to the consumer remains to be seen, and since that appears to be the most important weapon in the public power campaign in this country it will be interesting to watch France and England.

### *Smoke Abatement*

COMMUNITY uplift movements are being initiated or revived as the nation creeps back to normal peace-time tenor and one of the manifestations is a stirring among the smoke abaters. Health promotion is the commendable motivation and utility power plants will join in the corrective measures, the more heartily if the regulations and enforcement are intelligent and impartial.

Utilities can be counted upon, however, to suggest tempering of the requirements if they are ill-conceived, oppressive and overexaggerated as to objective benefits. They can be counted upon also to offer advice toward holding the aim to the basic one of health, not letting the issue become besmogged by inoperable details on fly-ash density, particle size, $CO_2$ content, volatility, "smokeless" fuel, etc. There are numerous other questions about shape and location of the sampling pan, weather at time of sampling, isolation of deposits windborne from remoter sources, sky illumination when using the dubious Ringelmann chart, dust from other than combustion sources, nucleation facilitated by condensation, etc.

The problem is admittedly complex and the "air-cleaning squads" should solicit and follow the advice of competent combustion engineers, meteorologists, physicians, chemists and the sounder brand of economists before jamming over-ambitious ordinances through city councils while riding on the town-beautiful wave. If they do they will be far more likely to win the allegiance of all the air polluters, among whom the power companies have come to be the least offenders as combustion has advanced.

### *Financing Capacitors*

IT would be difficult to overestimate the contribution to service improvement made by capacitors. The industry is fortunate in being able to obtain good deliveries of such equipment at generally satisfactory prices. Today, the capacitor is widely accepted. Its value as a regulatory device of high reliability is too well known to need elucidation; but it is still essential to apply it on an engineering basis, and to seek to obtain the maximum benefits justified by conditions and costs. Financing thus becomes increasingly important.

On individual power systems, it is logical to maintain complete control of capacitor applications for company service. This is true whether installations be made

on distribution circuits, or in substations or generating plants, by units or in combined groups, and with or without automatic switching. Capacitors so located belong to the utility. This policy pays for their installation and maintenance.

In connection with customers' installations, however, the question has arisen lately regarding how to finance this equipment. The objective should be maximum economic and operating benefits for each specific case.

A movement has been noted recently whereby the utility buys the capacitor units and the industrial customer pays for their installation and maintenance. This attempts to insure optimum results in power-factor correction and associated minimizing of out-of-phase current. Under this plan, the utility and its customer do not stop short of installing the kva. needed for the best service; installations are placed properly and wired at relatively small expense. Maintenance costs are low, often merely nominal over a long period. We emphasize "selected" industrial customers because such applications are not being made on a "come one, come all" basis, but only after a careful study has justified them. Where the benefit to the utility system warrants such capacitor purchases, this method seems of sufficient merit to warrant consideration by everyone.

### *Protected Hardware*

WITH LABOR COSTS where they are, there is more excuse than ever to buy for permanence since long-life equipment spreads the installation cost over a longer period. This broad assertion applies pointedly to protective coatings for exposed metal parts. Galvanizing is customary procedure for line hardware on utility systems, but even that good protection does not stand up too well under adverse atmospheres or seacoast sprays.

The protection afforded by galvanizing under more favorable circumstances really depends on the thickness and uniformity of the coating. Thickness in turn depends on the surface deposit and how much of it is retained when the work is removed from the zinc bath. If drawn carefully by hand and not centrifuged, the A.S.T.M. class B requirement of a 2-oz. average (1.85 minimum) can readily be met. Centrifuging to prevent accumulation in threads reduces the thickness at all points, so that the conformity may more nearly approximate the 1.25-oz. average requirement of class C coating. In fact, it was reported to the E.E.I. committee that a proposal had been made to lower the requirement for some unthreaded items to 1.5-oz. average (1.35 minimum) to permit centrifuging mass production reasons. Quite logically, there was objection to lowering a life-extending requirement in the prospect of a continuing call for durable installations. Manifestly, this situation wants notice by distribution engineers, particularly those unrepresented on E.E.I.'s line hardware subcommittee, or on the A-5 committee of A.S.T.M.

## WASHINGTON COMMENT

*By R. N. LARKIN*

ABOUT to be introduced as this is written is a bill which would realign rather drastically the marketing of federally developed hydroelectric energy. Sen. Elmer Thomas, Oklahoma Democrat, is expected to be one of the sponsors. Obviously, the bill, being new and far-reaching, will face considerable amendment, in committee and on the floor, before it ever reaches a vote.

Perhaps the most striking feature of the bill is that it turns over to the Federal Power Commission marketing jurisdiction which now rests in the Interior Department. As such, this would not only strip Interior of the jurisdiction over sales of Army-developed energy—an extension of authority for which Interior fought long and hard before winning it in the Flood Control Act of December 22, 1944—but also of authority stemming from older acts, the Bonneville, Boulder Canyon and Reclamation Acts.

While much industry sentiment probably would hail any such step—even in view of the past antipathy which the industry has had for FPC—the problem is not so simple as it would appear. Were this marketing jurisdiction to be so transferred, Interior would lose a function which it is set up to handle, and FPC would acquire one it is not now able to perform. The first result probably would be a sizable transfer of personnel between the agencies—a reshuffle rather than a new deal in federal power marketing.

One section of the bill sure to draw cries of great pain in REA circles is that providing preference in the sale of federal energy to federally financed rural electric groups "which are engaged only in rendering service to persons in rural areas not receiving central station service as restricted by the Rural Electrification Act of 1936 and amendments thereto." The stinger here is that the act requires REA-financed cooperatives to serve only outside the limits of municipalities which do not exceed 1,500 population. REA has been contending for years now that as it goes into ever thinner territory, it must take on, where it can, load centers which will enable it to carry the sparse territory on a pay-out basis. It has admitted a small but distinct list of violations of this restriction and justified them on this reasoning. Thus far, it has escaped serious challenge in doing so. FPC, in attempting to enforce any such provision of the new act, could easily be caught in an REA-private utility cross-fire.

Obviously, if FPC attempted to enforce such provisions meticulously, protests would arise from the sources which have been accustomed to evading it. The converse could be true if FPC were to bypass strict enforcement.

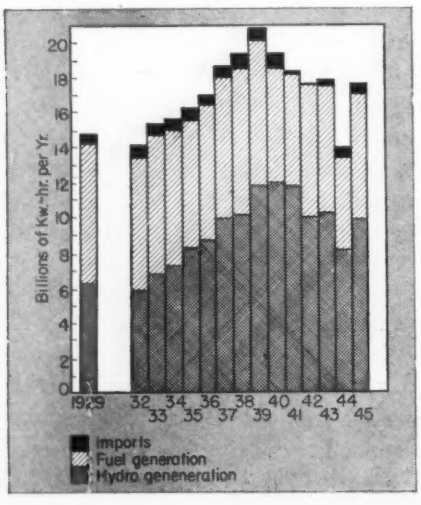
# WHAT HAPPENED WHEN France

***Control of electricity and gas operations by autonomous government bank is a natural development for a nation already accustomed to federal railroads, telegraph and radio . . . Management by national and regional agencies subject to taxes and normal business controls***

FRANCE took over financial control of all electricity and gas production, transmission and distribution at the beginning of 1947. The first great democracy, a country of 44 million people in an area of 212,650 sq. mi., has nationalized its utilities as effectively, although along a somewhat different pattern, as it already had for railroads, telegraph and postal services, radio and television. In an era of reconstruction, faced by years of deficit financing, with many fuel-burning plants of ancient vintage and poor efficiency, with prospects of continuing coal shortage, it is not unnatural that the weight of government finance and control should be needed to force an upsurge of electric power supply for industry.

Prior to nationalization France was served by 1,417 electric supply companies having a total generating capacity of around 6 million kw. Excluding several thousand very small plants, power before nationalization was generated by 327 companies. In addition there were 70 transmission companies and 1,550 distribution companies. Besides these utilities there were 961 enterprises producing electrical energy for public use but whose chief activity was not electrical.

FRANCE plans extensive development of hydroelectric resources aimed at doubling electricity production in six years by spending 1.6 billion dollars




Control of the major part of the production was in the hands of holding company groups. A French government report, introducing the nationalization act, stated that these groups represented from 90 to 95 percent of energy generated by electric utilities.

By the end of September, 1946, energy was being produced at an annual rate of 24.2 billion kw.-hr., up 26 percent from the same period of the preceding year and the highest by some 25 percent in the nation's history. Of this 53 percent is being generated from fuel and 47 percent from hydro. Fuel-plant capacity on the other hand is considerably more than hydro. Taking only the undamaged plants, the figures at the beginning of 1946 were 4 million kw. for fuel and 1.5 million kw. for hydro.

The reasons for the much greater use of hydro capacity are only partly the scarcity and inferior quality of available coal. More important, those now in charge of the French supply system state, is the fact that a great many fuel plants are old and a large number, concentrated in the north, are attached more or less directly to various industries. Most of the hydro on the other hand is comparatively new, having been built in the past 25 years. As will be seen from the accompanying table and chart this is the first time in more than ten years that fuel-generated energy exceeded hydro generation.

While the major areas of France are interconnected with transmission lines, many more are planned as will be seen on the accompanying map. The latest available figures, 1943, show the following:

| | |
|---|---|
| 220 kv. | 1,890 mi. |
| 100 kv. to 150 kv. inclusive | 4,080 mi. |
| under 100 kv. (but more than medium voltage) | 7,800 mi. |

All the widespread war damage to transmission lines, it is reported, has now been repaired.

### *Reasons for Nationalization*

Almost as soon as France was liberated the government proposed nationalization of key industries, among them electric service. The reasons, as outlined to the National Constitutional Assembly by Deputy Paul Ramadier, were partly political, partly social and very largely economic. "The nationalization of electricity and gas," he said, "is really much less an expropriation for the benefit of the nation than the reorganization of public service."

Demand for electric energy has risen continuously, he said, making it doubtful that normal peace-time conditions would result in an adequate supply. Because European coal supply could not be increased much beyond that of 1938, the main effort had to be in the direction of increasing hydroelectric production.

Moreover, since financial reserves were depleted and returns had decreased, it was believed that capital was so weakened that even if it could

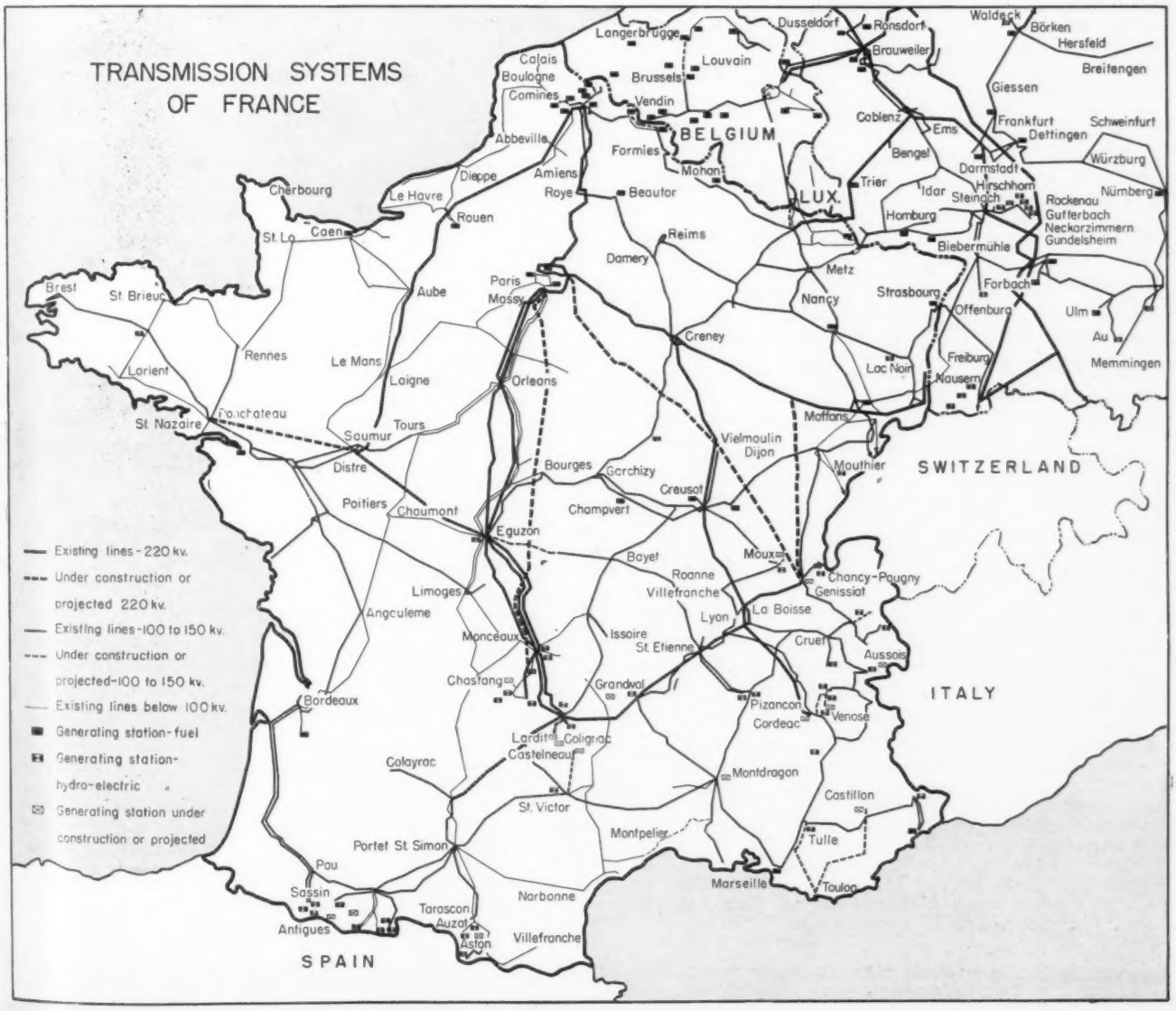
# Nationalized Utilities?

finance a program of expansion the government would have to take the initiative and assume the major risks. The program, which contemplates expenditure of more than a billion and a half dollars over the next six years, includes new hydro and tidal generation to turn out some 30 billion kilowatt-hours annually, as well as replacement, modernization and expansion of transmission and distribution and rural area development.

During the war, under government auspices, local loans, surcharges and measures taken by consumers supplied the necessary means for providing service, but the war rates did not take into account need for replacements.

Although in the past 30 years the

**TRANSMISSION** grid already effective in northeast and southern sections is to be extended under nationalization program to include all industrial areas with supply from projected plants in Rhone Valley near Swiss border



French electrical industry has, through interconnections, passed from a regional to a national operation, rates have continued to be different from one end of the country to the other and rural rates are high. Efforts to correct this situation by law were made in 1935 and again in 1936 without great success.

Cost of generation also varies widely either because of local conditions or age of plant while the cost of installation per kilowatt-hour output has increased from a level of 1 franc in 1928 to between 5 and 6 francs now. This, it was stated, would tend to slow down the pace of new construction unless there was government subsidy, since high-cost plants would have difficulty in disposing of their output when power from low-cost plants was available.

In promoting this program of nationalization its sponsors took pains to point out that this is not a part of a socialist program but rather that "nationalized business and industries

## Features of Act Nationalizing French Electric Service

**Passed April 8, 1946**

**INCLUDES:** All generation, transmission, distribution, import and export of electricity. Industrial installations necessary in the public service are required to transfer ownership of only such installations as pertain to public service.

**EXCLUDES:** (a) Electrical installations operated by national railways and mines.

(b) Small companies whose average annual output in 1942 and 1943 was less than 12 million kw.-hr., but when they exceed 15 million kw.-hr. they will be nationalized. (c) An industrial installation that cannot be separated without damage is nationalized but managed by a joint committee.

(d) Does not include properties held outside in territories, protectorates or foreign countries, except Algiers and colonies under conditions fixed by ministerial decree and with a delay of not more than one year.

**AGENCIES:** Management by a public commercial and industrial agency known as Electricité de France, Service Nationale (EDF), composed of six sections, to plan, construct and operate generating plants. Status and autonomy of these sections to be covered by law to be enacted prior to March 31, 1947. Distribution will be in hands of regional agencies called Electricité de France, Service de Distribution. EDF to set up boundaries of regional distribution agencies.

**AUTONOMY:** EDF given financial autonomy and technical and commercial independence. Required to follow commercial and industrial practice in financial matters. Subject to taxation and to control by accountants, two in number for each autonomous service, who shall operate as though employed by private companies—reports to be made public. Both national and regional agencies have authority to operate in all respects as though private organizations.

**ADMINISTRATION:** (a) National services (EDF) are administered by a board of 18 directors named by minister of industrial production (six representatives of the State, six consumers, six employees). Operation of gas and electric service is under separate general managers and administrative councils, one of which may be a member of Parliament. Council presidents and general managers may receive no outside compensation from private companies. General managers to be named by Council of Ministers and to be people of proved competence in the profession. (b) Regional distribution services are administered by a council of 18 named by EDF (four national representatives, six employees, eight consumers). Consumer representatives number six from local organizations (*collectives*), one from industry named by chamber of commerce and one from agriculture. Collectives have voting power in accordance with population. Manager of distribution service is named by Council of Ministers, confirmed by EDF and chosen from men of proved competence.

Directors are civilly responsible and may be removed for serious errors.

**CONTROL:** (a) A chamber of accounting, chosen by Council of Ministers from reputable people of industrial and commercial experience who may not have other occupation, verifies reports and controls the management of the several public agencies.

(b) At the end of each year each public agency renders a report. Within six months the accountants examine the reports and within the next six months the auditors report on the regularity of the accounting.

(c) Within three months of receiving the accountant's report, the minister of industrial production presents his report to Parliament.

(d) A Superior Council of Gas and Electricity is created to consult on the extension of regulations and to be the arbitrator of last resort between parties created by the Act. This council has equal representation from Parliament, the administration, local collectives, customers, national service and employees.

(e) Fines and prison sentences are provided for infractions of the Act.

**INDEMNIFICATION:** All goods, rights and obligations of companies whose principal activity is in the production, transmission and distribution of electricity are transferred to the national service. Subsidiary stock is not affected provided it is not included in the main enterprise as a related part. Payment in 3 percent, negotiable, 50-year bonds of the Caisse (bank) Nationale d' Equipment de l'Electricité et du Gaz. Stockholders in companies whose shares are listed shall exchange their shares at the average price between September 1, 1944, and February 28, 1945, or on June 4, 1945, whichever is greater. Stockholders of companies not listed on the exchange will be indemnified according to liquidation value of the property. Founder stock, preferential rights, etc., are recognized in the over-all liquidation. Facilities acquired from industries are indemnified on the same basis as utilities. Foreign stockholders are protected by degrees countersigned by ministers of industrial production, of foreign affairs and of finance. An additional (complementary) variable interest dependent on receipts is provided for beyond the 3 percent bond coupon.

**PROFITS:** Profits from the operation are retained in part for the administration and expansion of the system locally and part goes to the National Service. The ratio is determined by the ministries of production and finance. Profits on the national operation go to a national fund for development, which fund receives equally a part of the Distribution Service profits. This national fund is to be used by EDF for financing investments and to make possible long-term loans to distribution services.

**FINANCING:** The Caisse Nationale d'Equipment de l'Electricité et du Gaz, an autonomous financial agency, is set up to provide financial means for acquisition and development and for assuring the service of the bonds given in payment. It coordinates and controls the obligations between the national and the regional distribution services.

The Caisse is established as a contractor of loans and finances for the EDF and the distribution services. Amount and character of the loans have to be approved by the minister of finance and guaranteed by the State.

From their earnings EDF and the distribution services shall deposit with the Caisse sums necessary to pay interest and amortization services on all loans and bonds and such complementary interest as may be earned, and not below 1 percent of the receipts for the service of complementary interest.

Administration of the Caisse shall be a council of 14, the president of which is named by decree. Four State representatives are chosen, one each by the ministers of agriculture, national economy, finance and industrial production. EDF has three representatives and gas two, one of each to represent distribution. The National Credit Council has four representatives and the National Bank of Agriculture has one.

The Caisse conforms to commercial and industrial practice, is subject to taxation and operates under the control of two or more appointed accountants.

**EMPLOYEES:** All employees remain in their positions. Employees are represented upon the administration boards.

are islands of collective economy in a regime of individualistic or capitalistic production."

### *Higher Rates*

Every effort appears to have been made to effect a business-like autonomous operation as remote as possible from government and political interference. One indication of this may be the fact that on May 1, 1946, industrial rates were raised 20 percent and on July 1 basic residential rates were increased from 4.04 cents to 4.86 cents per kilowatt-hour. This increase, however, applies only to the Paris area. Other rates have not been raised.

These rates are 2.74 times the 1939 level. However, wholesale prices in France generally have risen to 7 times the 1939 level according to the official government index, while for the Paris area the retail price index is officially 8 times the pre-war rate.

### *Nationalized Operation*

Those in charge of the operation want it understood that nationalization was not an act of expropriation. The government is not taking title through outright purchase of property or by condemnation, nor does it even remove the stockholders from further participation in the earnings. It is, however, taking over management, operation and financing. Stockholders will receive for their share 3 percent, negotiable, 50-year bonds which will pay additional interest in proportion to earning power through a levy of at least 1 percent on all sales of electricity.

Nationalization applies to all generation, transmission and distribution, including import and export of electricity, whether by utilities or by others for their own use (industrials) within continental France except for small properties whose average annual production in 1942 and 1943 was less than 12 million kw.-hr. Should they later reach 15 million kw.-hr. they too will be subject to nationalization. Also excluded are distribution systems owned by the national railroads and coal mines.

In all some 600 companies have been nationalized. The French have separated generation from distribution. The former is national in operation and is under the top body, the Electricité de France, National Service (EDF), while distribution is handled by regional public bodies called EDF, Distribution Service. These organizations are expected to pay their own way and are required to follow accepted industrial and commercial accounting and financial rules including payment of all management, capital and investment expenses as well as taxes. Conflicts between any groups created by this law are, as a last resort, to be arbitrated.

**Annual Generation of Electrical Energy**

(In billions of kw.-hr.)

| | Hydro | Fuel | Total | Percent of Hydro of Total | Imports |
|---|---|---|---|---|---|
| 1929 | 6.2 | 8.2 | 14.4 | 43 | 0.5 |
| 1932 | 5.9 | 7.7 | 13.6 | 43 | 0.5 |
| 1933 | 6.7 | 8.2 | 14.9 | 45 | 0.5 |
| 1934 | 7.2 | 8.0 | 15.2 | 47 | 0.5 |
| 1935 | 8.2 | 7.6 | 15.8 | 52 | 0.5 |
| 1936 | 8.8 | 7.8 | 16.6 | 53 | 0.5 |
| 1937 | 9.9 | 8.3 | 18.2 | 54 | 0.6 |
| 1938 | 10.0 | 8.7 | 18.7 | 53 | 0.6 |
| 1939 | 11.9 | 8.3 | 20.2 | 59 | 0.6 |
| 1940 | 12.0 | 6.8 | 18.8 | 64 | 0.5 |
| 1941 | 11.7 | 6.5 | 18.2 | 64 | 0.1 |
| 1942 | 10.0 | 7.6 | 17.6 | 57 | — |
| 1943 | 10.2 | 7.6 | 17.8 | 57 | 0.1 |
| 1944 | 8.1 | 5.5 | 13.6 | 60 | 0.2 |
| 1945 | 9.7 | 7.9 | 17.6 | 55 | 0.5 |

By an elaborate system of administrative boards, accountancy, audits and reports, management is not so much controlled as placed in a position where it can be accountable for its actions at all times. Being a public enterprise the plan brings employees and customers into the direction of the system. On a board of 18 directors for EDF National there are six representatives each for the State, customers and personnel.

Management, however, is kept out of politics by a provision that general managers shall be people of recognized professional standing.

As with private companies, the directors are civilly responsible and can be removed from office for cause. Operating personnel not only remains as before, but has representation on administration boards. Regional distribution services are also administered by a board of 18 members but named by the National Service (four National Service representatives, eight customers and six employees.)

Financing is kept separate from management and is provided by another public agency with financial autonomy, Caisse Nationale d'Equipment de l'Electricité et du Gaz which, subject to the approval of the Minister of Finance, can issue loans. These loans can secure State guarantee. When loans are longer than 15 years the fixed interest can be increased by supplemental interest that varies with the increase in sales. Service of the bonds given in payment for nationalization is assured by "Caisse."

Profits realized by the distribution agencies may be retained in part for their own investments, the remainder to be paid into the national service fund. An equalization and compensation fund is created by a percentage deduction from distribution receipts.

A three-way control is provided by auditors, a chamber of accounting and by Parliament. For each autonomous service (gas and electricity) at least two auditors are named by the minister of finance and have the same authority as with private companies. Their reports are published.

Annual reports are examined within six months by a chamber of accounting appointed by the Council of Ministers and within three months of receiving its report the minister of industrial production gives his report to Parliament on the electricity and gas situation.

Finally the "Conseil Supérieur de l'Electricité et du Gaz" made up of members of Parliament, state officials, local organizations, consumers, national services and employees advises on extension of regulations and arbitrate any differences.

The management personnel of EDF, which is composed of men long in the service of the industry, have expressed themselves to various visitors from this side of the Atlantic as being anxious to maintain communications with operators of the principal power systems in the United States.

# Fixture Maker Centers Advertising On Utility Lighting Engineer

GLENN H. WITTBRODT • Advertising Manager, The Edwin F. Guth Co., St. Louis, Mo.

**ALTHOUGH the point is not made in this article, the editors of ELECTRICAL WORLD regard the program here described as an outstanding example of "Electrical Interdependence" in action. In the Guth Key Selling Plan are brought together and directed to the one purpose of selling modern lighting the interests of manufacturer, distributor, contractor and utility. It is by such integration that the electrical industry will make most rapid progress.**

PRINCIPAL PROBLEM confronting the lighting industry today is that of protecting its own best interests in the face of unprecedented demand. The problem is to "Relight America!" right. If the job is done in slipshod fashion, by installing inadequate systems, by simple outlet-for-outlet replacement of fixtures, resulting in poor quality illumination, then the industry will suffer. It will suffer immediately by realizing a lesser volume of business, consequently a lesser profit all along the line—manufacturer, distributor, contractor and utility—than would be obtained if the job were done right. It will suffer also by adverse reaction of customers who thought they were buying modern lighting and soon discovered they had gotten only a poor substitute.

### *Results of Survey*

Appreciating this problem, the Edwin F. Guth Co. developed and is now carrying forward its Key Selling Plan which, the company believes, is the first complete plan for merchandising lighting in the commercial, industrial and institutional fields. Central figure in the plan is the utility lighting engineer.

It is impossible for the user to keep abreast of advances in the lighting art. It is sufficient for him to know where to obtain competent advice and guidance when he wants improved lighting. From a study made by the Guth Co. through leading trade publications in the indicated business fields came the finding that potential buyers of lighting would turn for assistance to utilities, 34 percent; to contractors, 25 percent; to architects, 19 percent; to wholesalers, 12 percent; to manufacturers, 10 percent.

The utility lighting engineer, more than any other, already enjoys the confidence of the potential buyer of lighting. Such confidence will increase because the utility man is a disinterested party as regards makers and installers of lighting equipment. He is in the best position to help customers get modern lighting because he is usually conveniently located to give them prompt personal service and already largely possesses their good will through previous contacts.

Moreover, the utilities have most at stake in the sale of modern lighting. They stand to gain or to lose considerably more in energy sales during the normal life span of a lighting installation than together do all others concerned in the sale and installation of equipment. Additionally, the commercial, industrial and institutional field represent the utility's major market. While these users are only 13 percent of total customers, they account for 69 percent of kilowatt-hour sales and for 54 percent of revenue.

### *Original Announcement*

It was in recognition of these points that the Guth Co. built its Key Selling Plan around the utility lighting engineer. The plan was announced late in 1946. It met with immediate, widespread approval. The original announcement, mailed to the trade, simply outlined the plan, its methods and goals, and made no request for comment or other reply. Yet the voluntary response, in the form of complimentary letters, amounted to a 6.4 percent return. The distributors' acceptance of the plan was particularly outstanding; 31.1 percent of them responded.

A national consumer advertising program based on the plan is now being carried on by the Guth Co. Fundamental purpose of the advertising, as of the plan, is to sell lighting first and to let consideration of fixtures, fittings, wiring and installation follow naturally from the main theme. Such sales strategy works to the benefit of all and Guth figures it is better to help make a bigger pie, knowing that a fair share will be obtained, than to fight for a bigger slice of a little one.

### *Advertising Campaign*

The consumer advertising campaign is running in such publications as *Fortune*, *Newsweek*, *U. S. News*, *Nation's Business*, the *Rotarian* and *Forbes Magazine*. It provides blanket coverage of the tremendous present lighting market. For more intensive appeal, the same theme is carried to the retail trade, office building, school, and industrial markets in the leading business publications in these fields. These consumer ads feature the values of modern lighting, illustrated with convincing examples, and refer interested readers directly to the local electric utility.

Regular schedules in electrical trade publications support the consumer advertising program. These schedules, together with direct mail, keep utilities, distributors and contractors informed on the latest lighting and product developments, so that they can offer buyers up-to-the-minute accurate information. It also promotes close cooperation between all members of the lighting sales team.

Additional to the advertising and promotional program, the Guth Co. is providing a number of practical sales helps, such as a rapid lighting calculator, convenient lighting analysis forms, specification sheets, and a master catalog with design data.

# atomic energy

# ITS FUTURE AND YOURS

**Atomics and power generation have, in the past year and a half, come to be intimately associated with each other in both the public and professional mind. In the pages that follow, ELECTRICAL WORLD scans not only the relations that exist between these two fields but the entire atomic horizon in the dawn of present knowledge and informed speculation. It also examines the projected pattern of atomic control and the organization upon which that responsibility rests.**

MAN has always been a parasite of the sun. Our bodies run on solar energy converted by plants. Our industries sometimes use the mechanical device of falling water to tap sunpower. More often they run on stored solar energy of coal or oil, accumulated by prehistoric plants which used radiation from the sun to pack chemical elements into unstable arrangements which release their energy when they rearrange into more stable forms.

On December 2, 1942, man tapped an entirely new source of energy independent of the sun. This was energy stored before suns were formed by subatomic particles packed together to form the unstable heavy elements uranium and thorium. On that day physicists demonstrated that several tons of uranium embedded at a certain spacing in many tons of graphite would generate heat continuously in a controllable, self-sustained process.

Applications of that discovery have already revolutionized one major industry—war—and have fundamentally changed the balance of international strength. Recently alert industrialists have begun to realize that such a basic change in fuel and power supply is certain to have far-reaching effects particularly when exploitation of the new development has behind it the full resources of government.

No prudent business man or engineer dares plan or decide his course more than about five years ahead without weighing the possibility that the basis of his planning may be altered or upset by commercialization of atomic discoveries.

While firm answers may still be several years away, the very questions obscure such details as plant location, process design and raw material handling. Among men close to atomic development there is increasing agreement, frankly speculative, on early atomic applications. Foremost among these is electric power generation.

Opinion favors experimental, but substantial, production of kw.hr. from atomic sources in about five years, perhaps less. Piles already planned at Oak Ridge, Schenectady and Chicago are scheduled for initial operation within two or three years. The five-year estimate reflects promising results of preliminary investigations leading to the three installations now on the drafting boards.

Technical data on electric power production from atomic sources is widely available to the limited extent that it is free of military security regulations. Farther in the background is complementary and equally vital information on how the discoveries are to be fitted, if at all, into the framework of existing electric power industry. It is the purpose of this brief review to spell out, as far as is now possible, existing knowledge and informed speculation on how atomics are to become applied to the power industry.

A STAFF REPORT TO THE ELECTRICAL INDUSTRY

## EACH NEW FUEL

From wood to coal, coal to oil, oil to high-octane gasoline, each new fuel has caused a revolution in engines of utilization. Yet none of these changes have been in the ratio of a thousand to one, as now afforded by atomic energy.

All pre-atomic fuels depend on exchange of electrons in the atom's outer shell to produce energy by amalgamating atoms to form chemical compounds. Atomic fission, an entirely different process, derives energy from breakup of the innermost assembly, the nucleus.

All atoms are composed of a positive nucleus, comprised of protons and neutrons, surrounded by from one to seven electron-orbit shells with never more than 32 electrons per shell.

Atomic nuclei were split before Dec. 2, 1942 by devices such as the cyclotron, betatron, synchrotron and Van de Graaff generator; but each of these consumes far more energy than is released.

Least stable, least shatter-resistant nuclei are the most complex, heaviest atoms. They have more components, at greater average-distances from one another, than less complex atoms.

Uranium, heaviest atom in nature, is the only one so far split in quantity, (plutonium of course is a manufactured product using uranium as raw material).

So far, only one-tenth of one percent of the energy contained in uranium atoms has been utilized. Einstein tells us that the wrapped-up energy in one pound of anything is 11.4 billion kw. hr. One-tenth of one percent of the energy in one pound of fissionable material equals the heat of combustion of 1400 tons of coal.

## CHRONOLOGY

**1789** Uranium discovered by Klaproth

**1895** X-rays discovered by Roentgen

**1896** Becquerel finds uranium to be radioactive

**1897** Electron discovered by J. J. Thompson

**1905** Einstein declares mass and energy are equivalent and interchangeable

**1919** Rutherford discovers proton

**1932** Chadwick discovers neutron

**1939** Hahn and Strasman find lighter elements present after bombarding uranium with neutrons

Dunning and Fermi split uranium atom with great energy release

**1940** Nier separates U-235, only active isotope

**1942** Chain reaction in uranium pile found self sustaining by Fermi

Oak Ridge and Hanford planned

**1945** July 16, first atomic bomb detonated at Los Alamos, N. M.

Aug. 6, bomb dropped on Hiroshima

Aug. 9, bomb dropped on Nagasaki

Aug. 11, Smyth report released

Aug. 14, Japan accepts peace terms

Dec. 20, McMahon bill to Senate

**1946** July, pilot atomic power plant planned for Oak Ridge

Nov., plan to construct atomic power laboratory announced by General Electric Co.

# A NEW TECHNOLOGY

POWER PRODUCTION from atomic piles has been a fact for several years. The three piles at the Hanford plutonium works produce power as heat comparable with that of Grand Coulee Dam. But it is produced at too low a temperature to be used for anything except to heat the Columbia River by a matter of degrees.

The new power piles will be designed to operate at temperatures similar to those of a modern, high-pressure steam plant. Some fluid which can attain high temperatures without creating high pressures will be heated in the pile; in a heat exchanger, it will generate high-pressure steam to operate more or less conventional generating equipment.

New piles of the Clinton Laboratory at Oak Ridge and the Knolls Laboratory at Schenectady are designed specifically for power production. The Argonne Laboratory's new pile at Chicago, though intended for general experimentation, will run at high temperature and will incorporate a heat exchanger. It is a safe bet that any of the future piles being planned—in the United States, in Canada, in England—will be designed to utilize the power they necessarily produce.

### *Cost Balance*

Cost will not be an obstacle to the use of atom-fueled electricity. Only official word so far on cost is the estimate of 8 mills per kw.-hr. submitted by R. C. Tolman, scientific adviser to the U. S. delegate to the United Nations Atomic Energy Commission. This figure is some 30% higher than costs of coal-generated power in areas where coal is plentiful. But it would make atomic power economical where coal costs above $10 per ton.

If, as now appears likely, Europe and England face permanent shortages of coal, then atomic power, even at 8 mills, could be a matter of economic life or death wherever large hydro power is unavailable.

Many engineers and physicists in atom work are convinced, however, that the official figure is far too high—deliberately was made ultra-conservative. They consider it a power source which, from the start, will be competitive with other fuels.

The most optimistic prediction is that within 20 years, most new, large central station installations will be atom-fueled. If this prediction be even partly right, the effects on the coal and oil industries, the railroads, the industries using oil and coal as raw materials, and the industries tributary to all these groups are incalculable.

A complicating factor in costs is the question of by-products. An operating pile always produces valuable radioactive materials and may perhaps be used for experimental, metallurgical, or chemical purposes other than power production. Pricing of atomic power probably will involve some of the complications encountered in distributing the costs of a multi-purpose hydro-electric project.

Supply of atomic fuel does not appear to be an obstacle, either. Uranium and thorium, the two known natural fuels, are rather plentiful. Known world resources of good ore are said to be sufficient to meet the world's total power needs for something like 20 years.

Statistically, uranium is a fairly common element, scarcer than copper but more plentiful than tungsten, zinc or lead. Thorium is about three times as plentiful as uranium.

Once the technical problems of building commercial atomic-electric plants are worked out, installation where they are needed probably can proceed rather rapidly, dependent upon the international situation. The fissionable material now being manufactured and stockpiled for military purposes can, if it be released, provide the initial charge for power piles.

### *Isotopes and Transmutations*

It is as a power source that nuclear fission may be expected to have its immediate and massive economic effects. But it also opens the way to change the character of matter in ways that were never possible before

– or only on a minute laboratory scale. In the atomic pile, or in the bomb, energies never before available can be turned loose on the structure of matter. To try to estimate the impact of the atomic pile is nearly as useless as it would have been to guess the role of electricity from the properties of the Voltaic pile of 1800.

The one thing already obvious is that the old dream of transmutation of the elements is now an accomplished fact, and on a mass scale. Transmutation has been possible for years in the laboratory, using cyclotrons and other types of "guns" shooting sub-atomic particles. But always before, it has been on a scale too small to have industrial significance.

The biggest job of transmutation to date is the manufacture of fissionable material itself. One such material occurs in nature, the scarce 235 isotope of uranium. By using the energies of fission of uranium 235, the common 238 isotope of uranium is transmuted into the synthetic fissionable element, plutonium. Similarly, thorium, not readily fissionable, can be transmuted into a fissionable form of uranium.

It is quite possible that in the future, some of the rare but important elements may most easily be obtained, not by hunting for them, but by manufacturing them.

Equally significant is the manufacture of elements not found at all in nature – the so called "radioactive isotopes." These are elements with the same chemical properties as the natural elements but possessing the additional property of emitting radiation, much as radium does. Radioactive forms of nearly every element can be made in quantity in atomic piles.

The research and medical value of radio-isotopes has been well publicized, but their potential usefulness in many industrial processes is not as widely realized. Two uses are promising – radiation sources and tracers.

#### Industrial Tracers

As sources of high-energy, penetrating radiation, a package of radioactive material provides a comparatively inexpensive and compact way of doing many inspection jobs that now call for bulky X-ray apparatus.

A cheap and convenient source of radiation, also, may have revolutionary uses in the chemical industries. In many chemical reactions, radiation has a catalytic effect, permitting reactions at low temperatures which otherwise wouldn't occur at all, or only at high temperatures. This effect scarcely has been studied, except in photography, but already several oil companies are investigating its application to petroleum cracking.

Even such prosaic uses as sterilization of sewage and ionization of the air around a moving belt to dissipate static charges are being considered.

Radioactive isotopes get their value as tracers from the fact that even microscopic quantities can easily be detected by their radiation.

The ability to identify a particular bit of material has great research value in such a problem, say, as studying the exchange of metal between two surfaces of a bearing. But it is also true that a bit of radioactive copper included in the bronze of some inaccessible bearing would disclose wear in the bearing by a radiation check of the lubricating oil.

#### Metallurgical Uses

Cavitation of turbine blades might be detected in the same way. Proportions of alloying materials could be checked without chemical analysis. The possibilities are endless.

Radio-isotopes will be available to industry within a year or two. Wide use of power piles would make them a routine industrial tool.

Indicative of the ramifying applications of the atomic pile is the possible use in metallurgy. Subjection to neutron bombardment in a pile has a marked effect on crystalline structure of materials. Valuable results have been obtained by bombardment of ceramic refractories. And since the properties of most metals depend on their crystalline structure, many investigators think that neutron bombardment may prove useful as a new form of "heat treatment" producing properties not obtainable by conventional annealing and tempering.

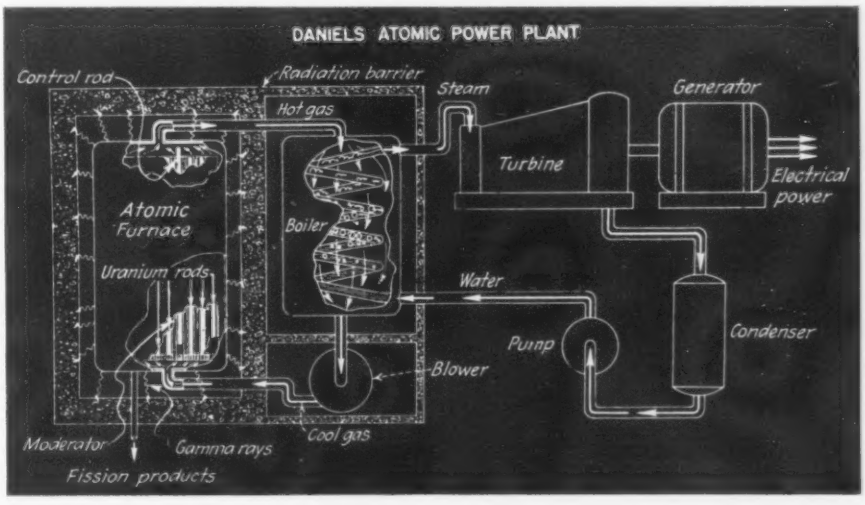
#### Future Developments?

In the offing is the possibility that the tool of uranium fission may lead to other energy-releasing nuclear changes. In theory, there are many such changes. When heavy elements break down, or when light elements combine to form middleweight elements, energy is released.

It has now been revealed that promising research is underway on energy from hydrogen. When atoms of hydrogen combine to form helium, much more energy is freed than by fission of the same quantity of uranium. Sun energy is believed to come from this combination.

Standard theory is that the hydrogen-helium transmutation can occur only at temperatures such as those in the sun – millions of degrees. If this be correct, it would seem that a chain reaction, generating heat at this temperature faster than it could be dissipated, could only be maintained in a body near the size of the sun.

Thus, hydrogen hardly would look promising as a controlled power source. But the announcement of research on hydrogen is widely taken to mean that a uranium bomb could be used to produce a flash of sun-scale temperature that would set off a quantity of hydrogen – perhaps resulting in a bomb a hundred or a thousand times as powerful as the old plutonium affair of World War II.



# NEW RESEARCH HORIZONS

SOMETIME IN THE 1950's, the Atomic Energy Commission may prove to be one of the most powerful economic planning agencies in the federal government. Today, AEC is a long way from that. It is two things:

First, it is an armament manufacturer. That is still the biggest part of its job, the part that accounts for most of its half-billion dollar yearly budget, the part that is carried on behind the curtain.

Second, it is a research agency, expanding our knowledge of the underlying principles of nuclear energy and learning the techniques of applying it.

AEC's research work now centers at four laboratories inherited from the Manhattan District:

Clinton Laboratory at Oak Ridge, operated by the Monsanto Chemical Company.

Argonne National Laboratory at Chicago, operated by the University of Chicago.

Berkeley Radiation Laboratory, operated by the University of California.

Los Alamos Laboratory in New Mexico, also operated by the University of California.

New laboratories under construction are:

Brookhaven National Laboratory, at Patchogue, Long Island, to be operated by a group of eastern universities.

Knolls Laboratory, at Schenectady, to be operated by General Electric.

Dayton Engineer Works, near Miamisburg, O., to be operated by Monsanto.

#### Pattern for Research

This rather hodgepodge assortment of facilities includes remnants of the bomb project, which AEC took over Jan. 1, 1947. Many decisions remain to be made regarding how research eventually will be handled. But the way policy is shaping up suggests that the final pattern will include these elements:

1. The Los Alamos Laboratory as a center for actual weapon development. It was here that the mechanism of the bomb itself was developed, and it is here that work still centers on atomic weaponeering.

2. Three or more laboratories operated by industrial firms and assigned pretty specific objectives. Thus, the General Electric laboratory at the Knolls is to concentrate almost exclusively on generation of usable power from atomic piles. Monsanto's Clinton Laboratory will probably emphasize the chemical problems of pile operation and the production of isotopes. What is to be done at the Dayton works has not been revealed.

Associated with each of these industrial labs will be an advisory or consulting group of other industrial firms, which will thus keep informed on what's being done and make what contribution it can.

3. Most of the fundamental research will center around a group of "regional" or "national" labs. Much of the outside contract research eventually will be handled through them, and they will guide and finance the bulk of the university nuclear research. Within very broad limits, these labs will be run, their policies determined, by the neighboring universities.

#### Research Laboratories

Argonne and Brookhaven are the two such units approved thus far. Another probably will be formed on the West Coast around the present Berkeley lab. Later, there may be a southern lab and one in the northwest. Ideally, every major university will be within an overnight train ride of one of these laboratories.

The laboratories in this group will have a double function. They will be regional and national institutions.

As a national organization, each will be responsible for a rather definite aspect of AEC's research program. No formal schedule of assignments has been drawn yet, but here is the current trend:

Central theme at the Argonne lab in Chicago is the design of atomic piles — at a somewhat more fundamental level than the engineering approach of the power program.

The immediately engrossing problem is to work out the features and characteristics of piles which run hot, at temperatures in the neighborhood of the 900-deg. level of modern steam plants. This is a considerable jump. The six piles now in existence all run hardly more than warm — either because, like the two research piles at Chicago, they have low power outputs; or because, as at Hanford, they are elaborately cooled.

#### Range of Problems

But including and stretching beyond this job are a whole range of problems to be investigated: relative merits of such moderators as graphite, heavy water, beryllium; characteristics of piles using uranium with varying degrees of enrichment in U235 or plutonium; the metallurgy of uranium itself, so little studied before the war that not even the melting point of metallic uranium was known with any precision; mechanical, chemical and nuclear characteristics of structural pile materials under conditions of an atomic fire.

The Brookhaven National Laboratory still hardly more than a few holes in the ground, a supply of carbon-block moderator, and a $20,000,000 construction allocation, will focus on basic nuclear research covering a wide scope.

It will work on such things as the nature of the different sub-atomic particles; the properties of the mysterious "binding force" that holds them together in the atomic nucleus, and whose release is the source of the energies of the atomic bomb.

#### The Atomic Gunners

If and when a national laboratory is set up on the West Coast, probably it will inherit the Berkeley Radiation Laboratory's interest in the design and construction of particle-accelerators ("atom smashers"). These accelerators have many forms —cyclotrons, synchrotrons, betatrons, linear accelerators. In one way or another, all of them exert power to set an atom or piece of an atom mov-

ing at very high speed. Modern machines can get particles moving so fast that they possess more energy than is released by fission of a uranium atom. In the offing are machines which will do four or five times as well.

Since the atomic projectiles from these guns have pre-determined energies and can be aimed where they're wanted, accelerators along with atomic piles, are the principal tools of the nuclear physicist.

#### *The Regional Role*

Although each of the national laboratories seems destined for its own field of concentration, each will serve also as a regional center for the nuclear research carried on in all neighboring universities and research institutions. This is a job with several facets:

In the first place, each laboratory will be a pool of equipment for the universities. The tools of modern nuclear work—piles, accelerators, "hot labs," and the like—are tremendously expensive—beyond the resources of most colleges. In general, government financing of university atom studies will channel through regional labs.

Within the atomic field, AEC will not simply farm out to the universities work it wants done; it will also help finance almost any worthwhile research in the field. There will be at least three different levels of work at each of these labs.

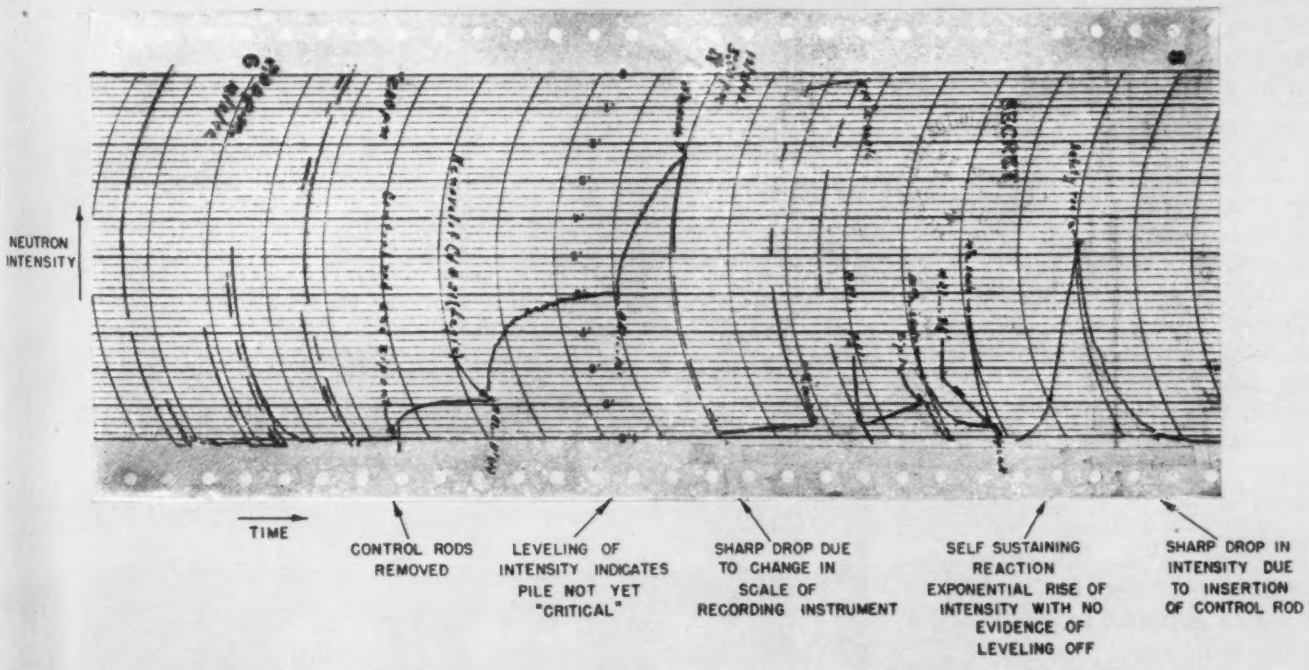
There will be "sponsored" programs of research, which normally will originate when someone on a university staff brings in a line of work he would like to undertake—and the work seems to fit rather definitely into AEC's program.

Then there will be "participating projects," of scholarly value to the general field of atomics, but not specifically of interest to AEC. (Example: An agricultural scientist might want to subject seeds to varying intensities of neutron bombardment to increase the percentage of mutations so that he could select the useful variations. This could be a participating program.)

#### *Industry Participation*

In this system — still young and somewhat tentative, drawn in terms of university problems—little thought yet has been given to use of regional laboratories by industrial researchers and other agencies.

Today, an industrial firm probably could get access to lab equipment by contracting with a participating university for research. A firm might even be able to put its own people in the lab—provided it waived proprietary interest in the results.


NEUTRON INTENSITY
TIME
CONTROL RODS REMOVED
LEVELING OF INTENSITY INDICATES PILE NOT YET "CRITICAL"
SHARP DROP DUE TO CHANGE IN SCALE OF RECORDING INSTRUMENT
SELF SUSTAINING REACTION EXPONENTIAL RISE OF INTENSITY WITH NO EVIDENCE OF LEVELING OFF
SHARP DROP IN INTENSITY DUE TO INSERTION OF CONTROL ROD

## "...THE NATIVES WERE FRIENDLY"

**The right end of this chart records what is probably one of the turning points of human history — the moment when the first atomic chain reaction began in the uranium-graphite pile built under the Stagg Field stands at the University of Chicago.**

**On Dec. 2, 1942, erection of the pile had been finished and the time had come to see if it would work. After a morning of preliminary checking, the group of physicists working under the Italian physicist Enrico Fermi adjourned for lunch. When they returned at two o'clock, the crucial test began.**

**The pile was controlled by two boron-steel rods, which absorbed large quantities of neutrons and prevented a chain reaction.**

**First the emergency rod — known as ZIP — was withdrawn and tied. (A man with an axe stood near the rope.) Immediately the level of activity in the pile, due to spontaneous radioactivity of the uranium, rose sharply.**

**But it levelled off. There was no chain reaction.**

**The main control rod was withdrawn six inches. The activity level rose even more steeply, so steeply that the scale of the chart was reduced to keep the pen on the paper.**

**But again the curve levelled off, as was evident when the graph briefly returned to the larger scale.**

**Finally the control rod was withdrawn once more. This time the neutron activity climbed steadily with no sign of leveling. ZIP was returned to the pile and the activity halted.**

**An atomic chain reaction had been started — and stopped.**

**A few minutes later, Arthur Compton called James B. Conant, at Harvard. He had no pre-arranged code. Said Compton:**

**"The Italian navigator has landed in the new world."**

**"How were the natives?"**

**"Very friendly."**

# PATTERN FOR CONTROL

WHEN COLUMBUS discovered land beyond the Atlantic, when Magellan circumnavigated the globe, insiders weren't particularly suprised. Learned Europeans had assumed for centuries that the world was round.

Similarly, the atom bomb wasn't too startling to people who had been paying attention to the revolution in physics early in the century. What is really astounding are the political decisions precipitated by the discovery of how to release atomic energy.

Developed in perhaps the last stronghold of private enterprise, this new and far-reaching technology was immediately and almost unanimously accepted as a thing which must be socialized. More surprisingly, the recently non-internationalist U.S. government is insisting upon creation of an unprecedented political instrument for international socialization of the atom.

### *Atomic Law*

Under the McMahon Atomic Energy Act, every phase of atomic activity is under complete government control.

Key activity is the manufacture of fissionable material — plutonium or uranium which has been enriched in its fissionable isotopes, U235 or U233. This is a complete government monopoly. It is illegal for a private person to own any fissionable material or any equipment capable of producing it. Only exception is that equipment capable of producing negligible quantities may be used for research purposes, subject to a government license.

All patents in this field are junked. None may issue on any discovery usable solely in production of fissionable material. Moreover, all patents are nullified as far as production of fissionable materials is concerned. Discoveries in this area must go to the commission. It will pay for them what it thinks is proper.

Private ownership of uranium, thorium, or their high-quality ores remains legal, but all dealings in them, once mined, require commission license. AEC may requisition or condemn such materials or any deposit-bearing lands.

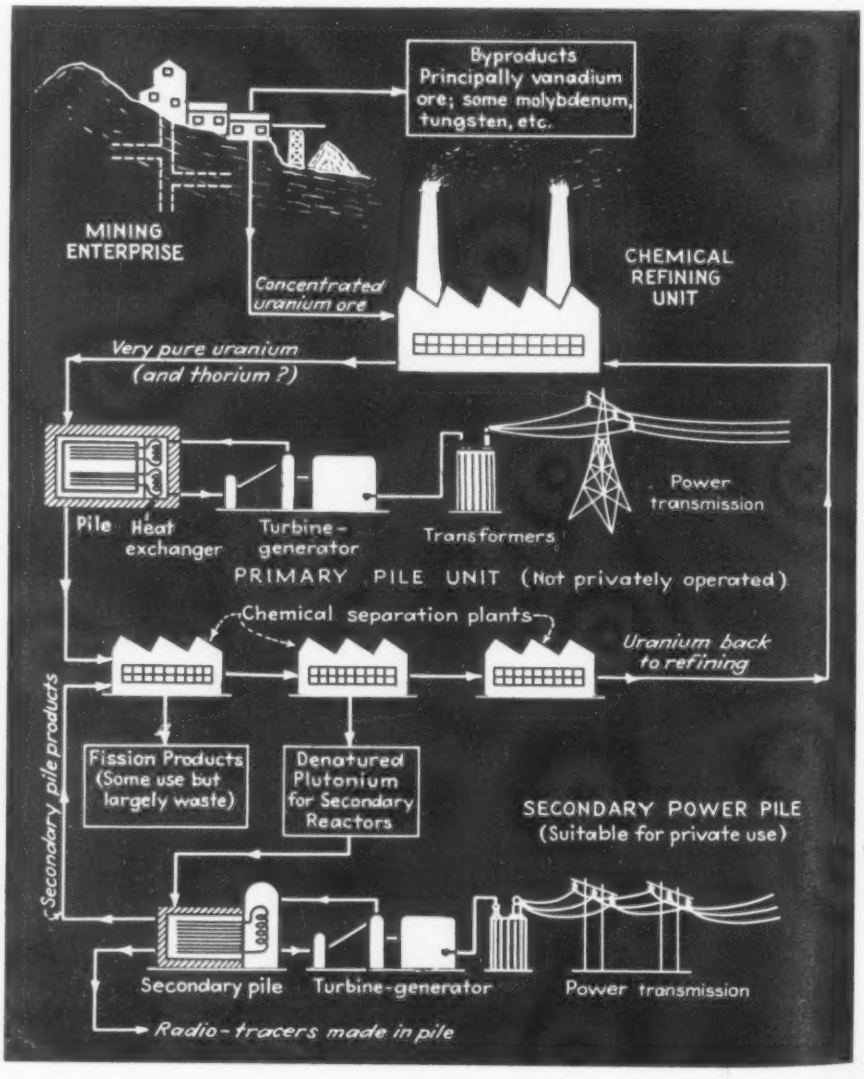
Private ownership and operation of devices using atomic energy is legal, but only under commission license. Licensing is completely discretionary with the commission; no standards are set except the public welfare and security and the maintenance of free competition.

Presently, no such devices exist. The only atomic engines ever built are the piles, and all existing types of piles manufacture as well as utilize fissionable material. Types which utilize only are possible; these would use the "denatured" material referred to in the Lilienthal-Acheson report. Whether they would be economic, by comparison with conventional piles, is a question.

Patents are permitted on utilizing devices. However, no one may monopolize the field. The commission may require that any such patent be made available at reasonable royalty to any AEC licensee.

The commission may also finance or conduct developments to utilize atomic energy. The law says nothing as to how the commission shall handle applications it develops; but AEC may use any power produced, deliver it to government agencies, or sell it to public or private utilities under contracts providing for reasonable resale rates. This last provision is an extension of existing U. S. policy favoring public ownership of electric power.

## THE ZONE OF CONTROL



Either through ownership or through its licensing powers, AEC has complete control over the rate and the manner of introducing nuclear technology into industry. The law leaves the commission almost unlimited discretion.

Congress did not intend this situation to be permanent; it is a temporary arrangement. Terms of all present commissioners expire in August, 1948. This will resurrect the atomic energy issue again after two years of peacetime experience — just in time, perhaps, to become an issue in the presidential campaign.

When AEC determines that any non-military application of atomic energy has attained practical value, it must report the fact to Congress, together with its estimate of the social and economic repercussions and its recommendations for legislation. Such application may not be licensed for 90 days thereafter.

#### Decisions Tentative

Thus, for all its powers, every commission decision has a tentative aspect. Essentially, AEC is an interim body. Inevitably, however, it will set patterns, create vested interests, that can not help influencing future Congressional review.

For a long time to come, the atom is going to be a political issue, comparable to taxes, labor relations and tariffs. The international negotiations on the atom, now making their sluggish way through the UN, introduce another big element of uncertainty in the picture.

Most of AEC's programs will have to be modified if the International Development Authority proposed by this country is ever set up to manage all the "dangerous" atomic operations. An international body could hardly assign operation of such a plant as Hanford to a U. S. business firm; it would doubtless have to use some sort of multi-national staff. International redistribution of production facilities — in the interest of political balance — might easily require disestablishment of some plants or equipment installed by AEC.

#### What Might Happen

Breakdown of the international negotiations might mean an end to efforts toward non-military applications of atomic energy — an all-out campaign of weapon development. Conversely, it might stimulate atomic-electric programs as an aid to industrial decentralization—preparation for an atomic war.

#### Pattern for Operations

Eventually, AEC will have to answer a plethora of economic and social questions—timing commercialization of atomic processes; establishing procedures; setting priorities; easing the impact on competitive industries; setting prices; determining licensing standards and policies; deciding precisely what activities are "safe."

Actively, the commission is seeking answers to many immediate questions. It needs a patent policy based on the novel and still-uninterpreted provisions of the McMahon Act; a consulting group of patent experts is studying this now. A group of leading accountants is establishing a decentralized financial system designed to minimize red tape, its objective . . . substantial autonomy for individual units within the limits of an annual budget. A permanent arrangement for villages around atom plants, now completely government-owned, must be found. They operate nicely, but paternalistically, now.

#### Operation By Contract

On one major point, commission policy is fairly well established. AEC will continue the Manhattan District policy of operating all its plants and laboratories by contract, rather than as purely governmental agencies. (This is a distinct change from Tennessee Valley Authority philosophy, which stands to figure substantially in AEC's thinking.) When AEC took over, about 50,000 of the atom workers were on contractors' payrolls and only about 5,000 were drawing government paychecks. This government portion is scheduled to decrease, if anything.

In some cases, the contractual relationship is pretty nominal. In others, the contractors are very much in the picture, exercising a large voice in policy, as is the case with General Electric at the Knolls.

Terms on AEC contracts are still treated as secret. It is known, however, that they are on a non-profit basis — cost-plus-nothing or plus $1. Cost, in these contracts, however, is interpreted rather more broadly than in the standard fee contract so as to protect the contractor against any possibility of out-of-pocket loss.

There is some question how long the non-profit arrangements can be maintained. Many businessmen doubt that the commission can get the wide industrial participation it wants unless it provides for some return to its contractors. "Somehow we must see to it that there will be something in it for industry," is the philosophy behind some present AEC thinking.

The issue is sharpened by the precautions AEC is taking to prevent giving its contractors too much of an inside track on ultimate commercialization of atomic energy. Chief among these is the device of an advisory or consulting board for each contractor, representing interested outside firms and assigned definite rights under the contract. This idea was first developed by the university people who have been working out schemes for administration of research, but it is being inserted by AEC into its contracts with the several interested industrial firms.

## MATERIALS FOR FISSION

**Only certain elements are unstable enough to be considered as practical for fission. They are the radioactive elements heavier than bismuth, No. 83 in the periodic table of elements. Even of these only the heaviest, including some not found in nature, have been seriously investigated. The radioactive elements are:**

| | |
|---|---|
| polonium (84) | protoactinium (91) |
| alabamium (85) | uranium (92) |
| radon (86) | neptunium (93)* |
| virginium (87) | plutonium (94)* |
| radium (88) | americium (95)* |
| actinium (89) | curium (96)* |
| thorium (90) | |

**all synthetic*

**Uranium is present in more than 100 minerals but only pitchblende and carnotite are now considered important. Pitchblende exists in Bohemia, Saxony, Belgian Congo, and Canada. Carnotite is found in Arizona, Colorado and Utah.**

**Other ores with appreciable uranium content are autunite, becquerelite, broeggerite, cleveite, curite, gummite, torbernite, and uraninite. One or another of these ores exists on every continent in the world.**

# G. E. BETS ON POWER . . . A Case History

One reason for the strong position which General Electric is assuming in the atomic field is that the gamble is safer for it than for most firms.

G. E. officials feel that the company's investment of executive effort is justified if only by the probability that exploitation of atomic energy will increase the use of electricity—which would increase its market.

G. E. can see more direct commercial business in the atomic offing. The odds are that there will be profitable business in furnishing the specialized and complicated associated equipment—the heat exchangers, control devices, chemical equipment. G. E. is determined to accumulate the know-how that will make it a logical supplier of that equipment.

Operation of Hanford bulks largest in G. E.'s atomic program, but the research work which will center at the Knolls atomic power lab is closest to the company's heart. G. E. wanted the atomic power research program, but doubted, at first, whether it wanted to take on Hanford.

Manhattan District badly needed an operator for Hanford. duPont was anxious to get out, fearful of being tagged again with the "merchants of death" label hung on it after the first World War.

After G. E. officials had taken a thorough look at the plutonium works, they decided it would complement excellently the research they wanted to do at Schenectady. They felt they needed the practical discipline of running an operating atomic plant in order best to perform the Knolls mission of finding out how to get the heat out of an atomic pile and into an electrical generator.

### *Production in the West*

Last September, therefore, G. E. assumed the management of Hanford. The transition was amazingly smooth. Of some 5,000 employees at Hanford, only about 75 left—most of them men with so much seniority in duPont they couldn't afford to stick with the atom.

G. E. installed its own works manager and assistant; accountant and assistant; and its own technical superintendent. Otherwise, it retained the previous management.

But major changes are scheduled for Hanford. One is the establishment of an engineering and design unit. A small fundamental research unit also has been established there, chiefly to maintain liason with the researchers at Schenectady. Another change is a school of nuclear engineering at Hanford.

All these reflect one basic change in operating policy—the carrying on of a development program at Hanford. Under wartime pressure to produce a reasonable quantity of plutonium and do it quickly, duPont necessarily operated a plant whose technology had been frozen at a fairly early stage in the development of the art.

### *Modernizing Hanford*

To simplify the mechanical design of the atomic piles, they are operated at quite low temperatures. Thus, it is practically impossible to use the tremendous heat energy released in the plutonium production process.

As it takes over on a peacetime basis, therefore, G. E. faces a long-range program of modernizing Hanford's whole operation. The ideal would be a set of piles whence most of the by-product power could be recovered; through which uranium could be circulated automatically; and with which would be associated a more or less automatic chemical plant recovering the plutonium while extracting or recirculating the other components.

Realization of this challenge, as much as anything, sold G. E. on the value of the Hanford assignment.

Just outside Schenectady, construction is beginning on the $20,000,000 Knolls atomic power laboratory. First of 800-odd scientists and about 600 technicians who will work there by mid-1948 are being recruited.

Owned by AEC and operated by G. E., the Knolls layout will include at least one atomic pile as well as physics, chemistry metallurgy and other engineering research facilities.

Although the Knolls atomic power lab will do much of the research work in connection with Hanford, its primary job is to develop techniques for utilization of atomic power—both in central station and ship propulsion equipment.

The Knolls researchers face tremendous engineering problems in transforming the pile's heat into useful energy. Typical problem is that of the heat transfer fluid. A fluid must be chosen which has good nuclear properties. This means it must not absorb neutrons — and so interfere with the chain reaction. It must not be transmuted by the energies of the pile into a less desirable substance. Such fluids as mercury, molten bismuth, sodium-potassium alloys or others capable of high temperatures without high pressures, are envisioned.

Mechanically and chemically, the fluid must be such that it can be handled, inside the pile, in pipes of material which itself will have good nuclear properties and will retain its strength and chemical characteristics in the face of the great heat and fierce radiations of the pile.

Since the fluid may not be water, its thermodynamic properties will need considerable study for heat exchanger design. Its corrosive action on other materials, if any, will have to be investigated. Extremely reliable means of pumping and valving it under conditions of great radioactivity will have to be found.

G.E. officials are counting for help on the somewhat similar problems they faced in the late 'twenties and 'thirties in perfecting the two-vapor cycle mercury-steam power plant.

### *Organizing for Nucleonics*

G. E.'s no-fee-no-patent contract specifies not only that members of the advisory committee set up by AEC must have complete access to G. E.'s atomic work. It requires also that G. E. appoint to its Knolls staff — up to 15 percent of personnel — people nominated by member firms of the advisory committee.

# MULTIPLICATION of SUBSTATIONS Found Most Economical

M. A. POLSTER*
Assistant to Superintendent
Electric Distribution
Consolidated Gas Electric Light & Power Co. of Baltimore

***Study of particular 30-square mile residential area in Baltimore indicates five 3,000-kva. substations less expensive than either a network or equivalent expansion of two existing substations—Advantage holds throughout load growth from 7,500 to 17,000 kva.***

STUDY by the System Planning Committee of the Consolidated Gas Electric Light & Power Co. of distribution for a 30-sq. mi. area, largely residential indicated a saving of from 17 to 21 percent if several 3,000-kva. substations were to be applied. These comparisons are with (1) expansion of two existing substations and (2) a 4-kv. primary network. The load which is covered by this study is largely residential supplied from 60-cycle, 4,000-volt feeders; load is now supplied by Westport and South Baltimore substations with two feeders out of the first substation and three out of the second substation.

The general Baltimore distribution system to which the transformers supplying utilization voltage are connected is 4,150-volt, 4-wire, star-connected with the neutral solidly grounded at the substation only. There are, however, several feeders in the rural areas which are multigrounded common neutral. The majority of the feeders in the metropolitan area are underground from the substation to the feeder point and a large proportion of these feeders also have underground mains. The main feeder between the substation and the feeder point in general connects through a manually operated oil switch to the feeder point. The feeder mains radiating from the feeder point in the several directions are equipped with manually operated oil switches for the purpose of sectionalizing. Ties to adjacent feeders are provided by means of manually operated oil switches. The 60-cycle feeders supplying the area covered by this study are of this type but are entirely overhead.

### *Purpose of Study*

Purpose of the study was to determine the most economical plan of distribution to the 4,000-volt, 60-cycle load in the area. It is expected that the present facilities will be inadequate in the very near future due to rapid increase in load resulting from housing developments, particularly in the Cherry Hill area.

Solution of the problem cannot be construed as a general solution for 4,000-volt distribution but applies for the conditions which are peculiar to this area. Three plans for the relief of this area, described as follows, were studied.

### *Plan 1*

*Plan 1*—Expand Westport and South Baltimore substations to a combined nameplate transformer capacity of 15,000 kva. Westport now has a 3,000-kva. bank and its capacity would be doubled by the addition of a second bank. South Baltimore substation, likewise, has a present bank of 3,000 kva. and under this plan, two additional banks of 3,000-kva. capacity each would be added. Radial 4,000-volt feeders would be installed to the several feeder points in the area as required. Accompanying map presents the layout as planned for this area for a load growth up to approximately 17,000 kva.

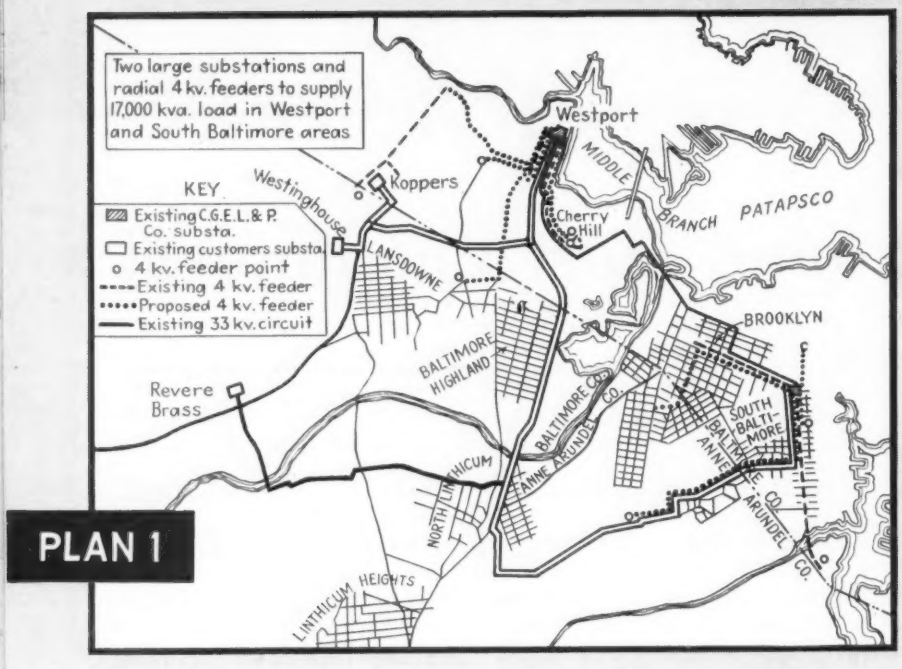
### *Plan 2*

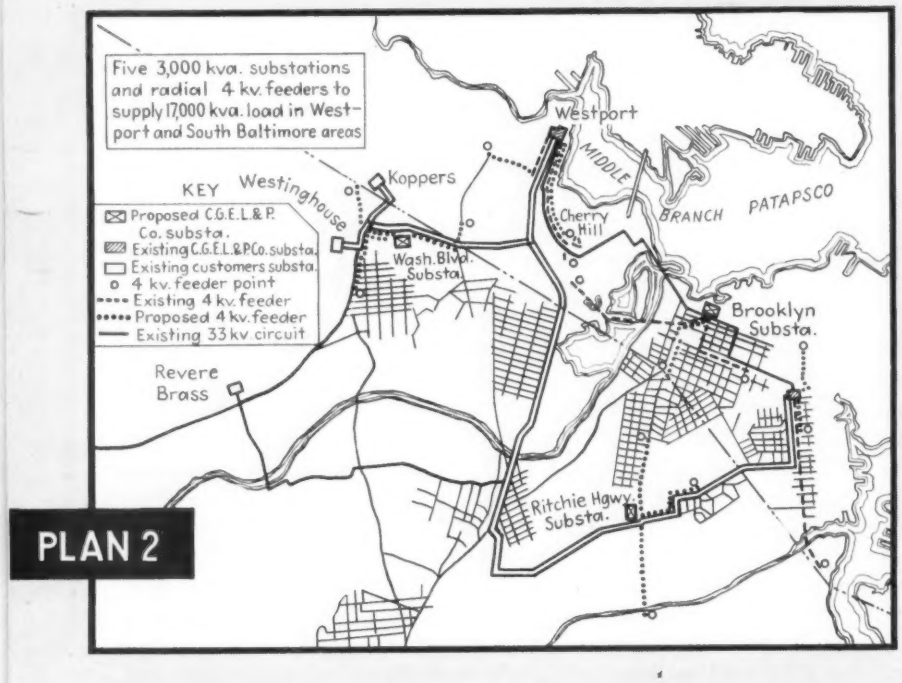
*Plan 2*—Supply the area by five substations of approximately 3,000-kva. capacity each with radial 4,000-volt distribution feeders. Two of these substations would be the Westport and South Baltimore substations which would be loaded to the limit of their capacity before the other substations are installed. The third substation would be installed when required and would be located at Brooklyn. This substation would relieve both Westport and South Baltimore substations and its approximate location is indicated on the accompanying map. The other two substations are also shown on this map; one designated as the Ritchie Highway substation and the other designated as the Washington Blvd. substation. These substations, of course, would be provided when required.

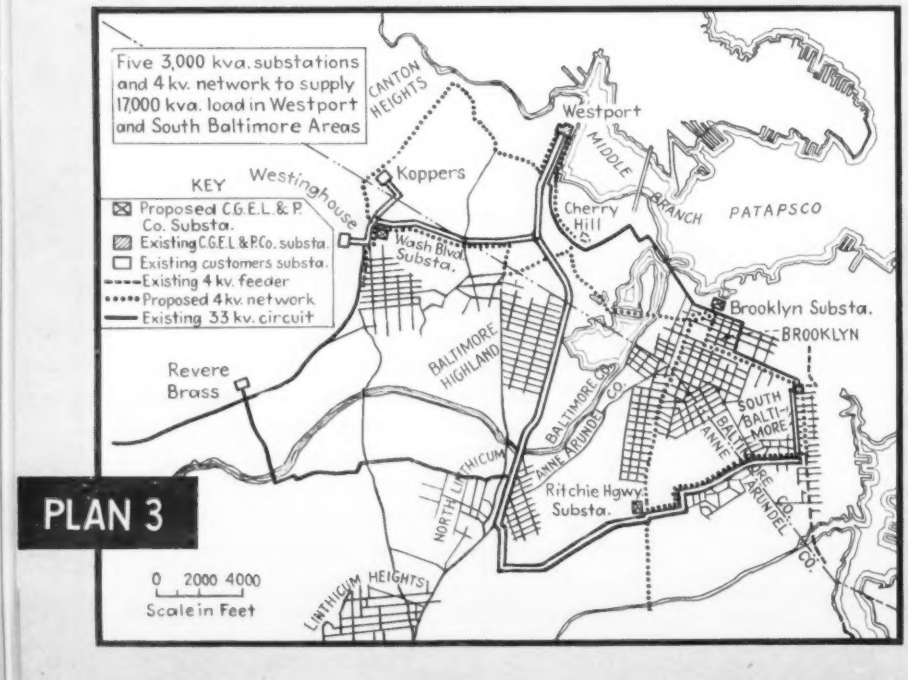
### *Plan 3*

*Plan 3*—This method of providing for the load in this area would be the same as Plan 2 but would have a 4,000-volt network instead of radial distribution feeders. The network would be sectionalized at each substation by the use of automatic cir-

* Adapted from paper in Distribution Economics series of the transmission and distribution committee of the Pennsylvania Electric Association.




cuit breakers. A map of this plan is also illustrated.

An estimate was made for each of these plans for the loads as contemplated in this area. The load at the present time is on the order of 7,000 kva. and the costs are based on the expenditures that it will be necessary to make as the load reaches various amounts as indicated in the following tabulation. It was previously pointed out that the total nameplate rating of the two substations now supplying this area is 6,000 kva. However, with forced ventilation, these oil-filled transformers have an increased capacity and this is being utilized at the present time in order to carry the present load. As the load increases, expenditures will have to be made as shown in the following tabulation. The time for making expenditures is indicated on the basis of load rather than on the basis of calendar years in order to minimize errors in forecasting. However, the maximum load considered in this study is expected to be realized in some twelve to fifteen years. The costs shown in the accompanying table are expressed in terms of their relative percentages and take into account the value of capacity used in existing lines and equipment.

### *Small Radial Substations*

Plan 2, as shown by the cost summary, is more economical than either Plans 1 or 3. This lower cost applies throughout the greater portion of the period studied; the saving amounting to approximately 17 percent of the next higher figure at the end of the growth period. There is also a probability that expansion of either of the Westport or South Baltimore substations may result in a somewhat greater cost than estimated because it will probably become increasingly undesirable to continue rearranging equipment and adding to the present 4,000-volt bus.

Plan 3 is the most expensive due to

**PLAN 1**—Two large substations and radial 4-kv. feeders to supply 17,000-kva. load in Westport and South Baltimore areas

**PLAN 2**—Five 3,000-kva. substations and radial 4-kv. feeders to supply 17,000-kva. load in same areas as Plans 1 and 3

**PLAN 3**—Five 3,000-kva. substations and 4-kv. network to supply 17,000-kva. load in same areas as Plans 1 and 2

the heavy 4,000-volt ties required to form a network and maintain voltage regulation within limits, although the service reliability of this plan is probably greater than that of the other two. It is believed that the greater expenditures required by Plans 1 and 3 are not justified in being made at this time. Furthermore, Plan 2 can be developed into Plan 3, i.e., into a network, at such time as it becomes desirable.

The transformers of the new substations would have automatic tap changing under load on the 4,000-volt side which would eliminate the need for induction voltage regulators. In other words, unit type substations are contemplated.

**Comparative Costs of Three Plans in Percentages**

| | | | | | | |
|---|---|---|---|---|---|---|
| Load of Territory in Kva..... | 7,500 | 9,200 | 11,100 | 13,000 | 15,000 | 17,000 |
| PLAN 1<br>Expansion of Westport and South Baltimore Substations with radial 4,000-volt feeders<br>Cumulated costs ..... | 30.0 | 44.3 | 64.2 | 85.6 | 91.0 | 117.2 |
| PLAN 2<br>Five substations with radial 4,000-volt feeders<br>Cumulated costs ..... | 25.6 | 36.6 | 65.0 | 69.8 | 72.0 | 100.0 |
| PLAN 3<br>Five substations with 4,000-volt network<br>Cumulated costs ..... | 30.00 | 40.3 | 75.5 | 82.5 | 89.8 | 121.2 |

### *Five Units Contemplated*

It will be noted that in each plan studied five transformer banks of 3,000-kva. nameplate capacity each are contemplated. The relative economy of each plan is determined by the locations of the substations and the method of supplying the 4,000-volt load. A new transformer bank would be installed under each of the three plans when the load for the area becomes 7,500, 11,100 and 17,000 kva., respectively.

There are 33,000-volt circuits available over a large part of the area under consideration and the new substations are contemplated being located at such a place that they may readily be tapped to an existing 33,000-volt line. This plan is largely responsible for economy of the five substations planned and, if needed, additional substations can be added.

### *33-Kv. Feeders*

The 33,000-volt feeders in the area are those which supply 60-cycle service from Westport to the South Baltimore substation. Westport is a generating station, is the terminus of a 220-kv., 60-cycle feeder and is the source of supply for a number of substations operating at 13,200 or 33,000 volts in addition to being a 4,000-volt substation. The proposed new substations described in Plans 2 and 3 would tap a 33,000-volt line, an air break switch being located on either side of the substation tap. Both of these switches would be normally closed as the feed is from Westport to South Baltimore. However, the new substation could be supplied from either Westport or South Baltimore and the air break switches provide the means for doing this.

An advantage of both Plans 2 and 3 is that no additional 4,000-volt feeders are required to be extended from the Westport or the South Baltimore substations where conditions are already congested. Additional 4,000-volt feeders out of these substations would add to the existing congestion. It is contemplated that the three additional substations would be unattended. Supervisory control could be added if and when desired. Westport and South Baltimore substations are attended.

# Wood-Stave Pipe Experience

IN RESPONSE to a questionnaire circulated by the Swedish Water Power Association in the autumn of 1941, information has been compiled on operating experiences relating to about 200 wood-stave pipes used in Sweden.

During the past few years, a modified type of continuous stave pipes, termed "group stave pipes," has come into use in Sweden. Every stave in one group is displaced by a half stave length with respect to the staves of the other group so that every second stave is jointed in the same cross-section of the pipe. For the purpose of reducing the bearing pressure between bands and staves, the use of flat steel bands has begun to be resumed in recent years. The shoes employed are made of pressed sheet steel or cast iron. The staves are usually from 60 to 80 mm. in thickness. The wood-stave pipes for water power uses reach a length of up to 1,670 m. (Furudal Hydroelectric Station, diameter of pipe 2.4 m.). The largest diameter of pipe now in use is 3.5 m. (Storfors Hydroelectric Station). The maximum head is 59 m. (Slagsa), the diameter of pipe being 1.1 m., but in most other cases the head is much lower, about 10 m.

Normal length of life of correctly designed and properly maintained wood-stave pipes may be assumed to be about 45 years in Sweden. Most of the pipes covered by the present investigation were not treated with any timber preservative. Among the protective covering materials employed for wood-stave pipes, clay has given the most favorable results.

Freezing is an all-important problem in the use of wood-stave pipes under Swedish climatic conditions. Out of the total number of wood-stave pipes covered by this investigation (197), 53 pipes, i.e. 27 percent, have frozen for some reason or other. Out of these 53 pipes, 13 pipes, i.e. 7 percent of the total number, have frozen in service and 8 pipes, i.e. 4 percent, have been completely clogged by ice. Prevention of freezing under normal intake conditions in Sweden requires that the specific velocity of water flow in wood-stave pipes without any covering should not be less than about 0.003 meter per sec.

# Shaving and Incising Machines Mechanize Pole Yard Operations

**FRED B. DOOLITTLE**
Engineer, Operating Department,
Southern California Edison Co.,
Los Angeles

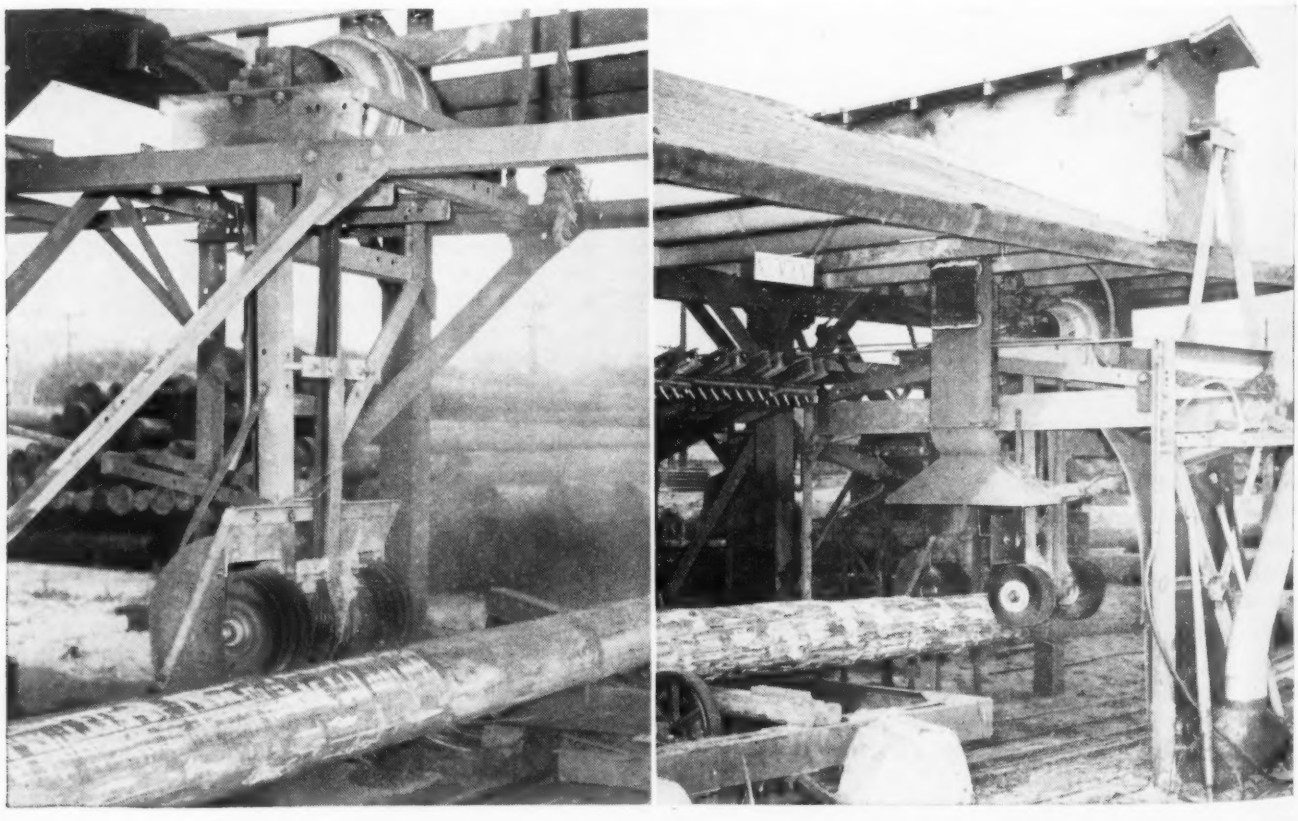
SCARCITY of labor during the war period to perform the work of shaving and incising poles led Southern California Edison Co. to seek mechanical aids to carry out these operations. Equipment developed not only solved this war-time problem but has proved a permanent and efficient step in the further mechanization of the company's Alhambra pole treating plant. Unlike most users of western red cedar poles, the Edison company treats all poles full length because of the prevalence of kalotermes (dry wood termites) in the areas served. Because of the full-length treatment it is necessary that all inner bark be removed from the poles before treatment. Otherwise, long shreds of creosote soaked bark would hang loosely from the poles, creating a hazard to linemen and a potential nuisance to the property owners.

### *Inner Bark Removed*

Practice had been to remove the inner bark from poles by hand labor using draw knives. Incising of the butts of some poles, which otherwise failed to take adequate treatment, was accomplished by manually operated incising hammers. If commercial pole shaving and incising machines had been available, they would not have been well suited to the company's operations because their production capacity is much greater than necessary and too many men are required to operate the machines. Furthermore, all known commercial shaving machines removed some sapwood in addition to the bark. Since it is only the sapwood of western red cedar poles that will absorb preservative it was considered undesirable to reduce the average ¾-in. thickness of sapwood on these poles by any appreciable amount, if avoidable.

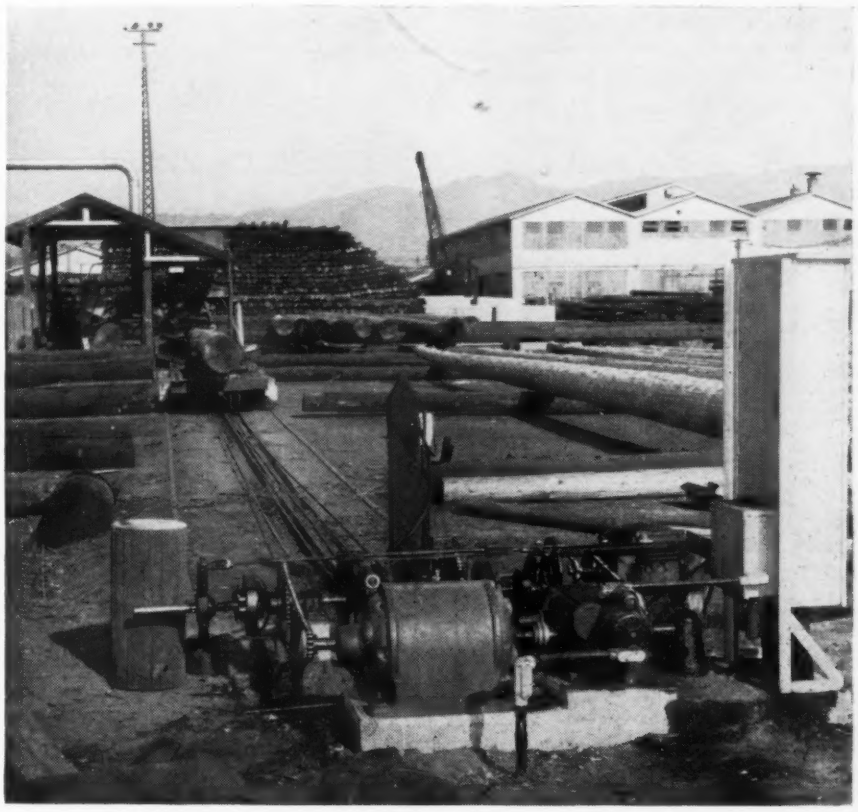
With this important limitation, attention was directed to a method of

STEEL WIRE wheels mounted on swinging arbor (left) effectively displace draw knives in removing inner bark from poles preparatory to full-length treatment. At right is completed shaving machine showing use of two double wheel arbors. It takes only about one minute to shave a 40-ft. pole with this labor saver. Gravity fall incising hammers displace more costly hand methods. Hammers strike one at a time in quick succession, each one jarring loose teeth of the one before



removing the bark making use of the abrasive action of steel wire buffing wheels. After some experimentation with a single buffing wheel vs. two wheels—circumferential and lineal speed of the pole—a very successful pole shaving machine was built. This equipment as shown by the accompanying illustrations consists of a variable speed carriage with rubber-tired wheels for holding and rotating the pole; two motor-driven, swing-mounted double mandrels, each equipped with two wire wheel brushes 12 in. in diameter by 6 in. wide; a cyclone dust collector; and control and accessory equipment. Experimentation showed that two wire wheels mounted on an arbor free to swivel about a vertical axis followed the surface irregularities of the pole better than a single brush twice as wide. To obtain satisfactory production rate, two such set-ups as shown were mounted to work on opposite sides of the pole simultaneously.

***War-time developments prove peace-time boon in utility's pole treating plant . . . Steel wire buffing wheels effectively remove inner bark for full-length treatment***



VARIABLE SPEED drive (foreground) for pole carriage. Shaving and incising machines are located in shed at rear

### *Speed Relations*

Speed of the buffing wheels is constant at 2,000 rpm. Variable speed drive permits turning the pole at speeds from 10 to 35 rpm. Carriage speeds may be varied from 12 to 45 ft. per minute. With two buffing wheels having a combined width of 1 ft., a carriage speed equal in lineal feet per minute to the rpm. rate of the pole results in brushing the entire surface of the pole once. With four brushes as actually installed, the same lineal speed of the carriage results in brushing the entire surface of the pole twice, which is necessary to thoroughly clean some poles having unusually tenacious inner bark (outer bark is taken off in the woods). Of course, carriage speed may be doubled, which results in covering the surface of average poles only once. A higher speed of approximately 160 ft. per minute for approach and return of the carriage is provided to save time of over-all operation.

### *Production Rate*

The machine was originally designed to shave and incise fifty 40-ft. poles or equivalent per 8-hr. day using two men. In actual practice this production rate has been exceeded as much as 50 percent and as this is greater than the capacity of the treating plant the same two men find time to gain and bore all the poles as well.

### *Incising*

It had been the practice of the company to butt treat thoroughly seasoned western red cedar poles after which increment borings were made in the treated sections of each pole to determine depth of penetration. Those poles having less than full sapwood penetration were segregated out and incised by hand methods and retreated. As the proportion of such poles amounted to about 25 percent of the total it became economical to incise all poles by machine to avoid sorting and retreating. As a result, the incising machine was a development from the hand operated hammers previously used. This machine consists of a series of cam-raised, gravity fall hammers. Performing the incising operation while the pole rested on the rubber tired wheels of the carriage, with elaborate clawhammer action to loosen the teeth, proved unsatisfactory and was replaced with an air cylinder to hold the pole off the wheels. With this resilient mount it was found that each successive hammer jarred the previous one loose, so a ninth blank hammer was provided to jar loose the eighth, or last hammer to fall. A man with a cant hook turns the pole slightly after each falling of the hammers to complete the incising operation.

War-time restrictions on the use of critical materials made it necessary to build the shaving and incising machines largely from what could be scraped together. Nevertheless, the result has been equipment that has proved very satisfactory and that has required no later modifications.

# Ignitron Converters For Induction Heating

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Westinghouse Electric Corp.
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CONVERSION of power from commercial power frequencies directly to higher frequencies which are required for the induction heating and melting of large volumes is possible with recently developed ignitron cycloinverters. Three-phase 60-cycle power is converted to single-phase power at a higher frequency by means of a single conversion. This new type of converter, together with the vacuum tube oscillator, which is particularly suited for heat treating, makes it possible to supply induction heating and melting with power from electronic equipment.

Applications of gaseous tubes have usually been limited to the commercial power frequencies, but as the demand for power in the higher frequency ranges has increased, it has been found that there is an important field which can be supplied by gaseous tube converters. The largest kilowatt capacity of induction heating equipment is installed in the relatively low frequency range mainly for the production of stainless steel and other alloys which require close control and for the heating of billets.

In the past, rotating machines have been used exclusively in the large power induction heating field because of their relatively high efficiency. With the development of gaseous tubes which can control the flow of current at higher frequencies, power in the frequency range from 500 to 2,000 cycles per second can be obtained by means of gaseous tube converters with higher efficiencies than the rotating machines. In addition, the gaseous tube converters have all of the advantages of vacuum tube oscillators such as quiet operation, light weight, low starting kva. demand, immediate accessibility, variable frequency, and adaptability for automatic operation.

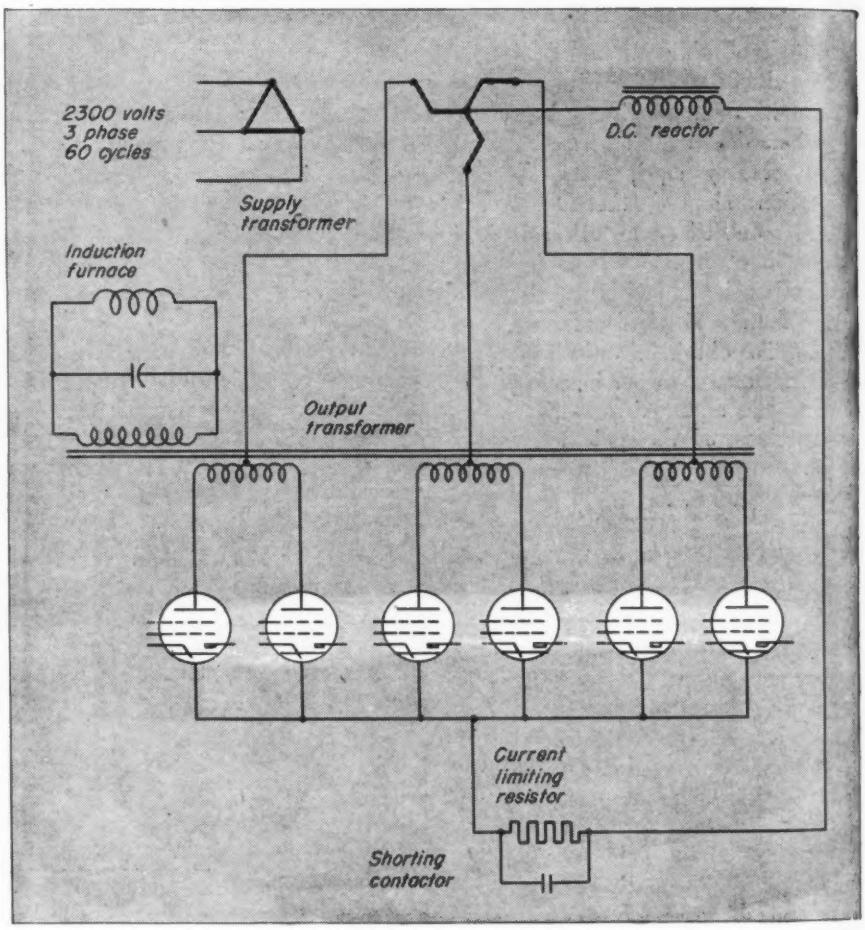



FIG. 1—Three d.c. to a.c. parallel inverters are used in the single cathode cycloinverter

### *Conversion Requirements*

It has been known for many years that gaseous tubes can be used to convert d.c. power to a.c. power by means of inverter operation. The wide application of these inverters was prevented by many limitations, but one of the major restrictions was the requirement for double conversion of the power from a.c. to d.c. and then d.c. to a.c. of the desired frequency. With the gaseous tube converter power from one frequency is converted directly to another frequency. The efficiency of the conversion is greatly increased and the total amount of conversion equipment is reduced almost one half.

The common cathode circuit shown in Fig. 1 is made up of three d.c. to a.c. parallel inverters. The circuit operates such that only one of these parallel inverters is operating at any one time. Each pair of tubes conducts only when the voltage of its phase is more positive than the voltage of the other two phases, and thus conducts for about one-third of the time. Rectification of three-phase, 60-cycle power and inversion from d.c. to a.c. occur simultaneously. The three pairs of tubes can be con-

* Abstract of paper presented at National Electronics Conference Chicago, October 3-5, 1946.

sidered to operate as a three-phase rectifier. It is possible to fire the ignitors of the tubes at the input frequency which in most installations will be 60 cycles. The conduction of the current at the high frequency rate in any one phase is then controlled by means of the grids. The low energy requirements for grid control and the short deionization times which can be obtained make it very desirable to use grid control for the high frequency.

The output of the cycloinverter is modulated at a frequency which is three times the input frequency because of operation on the three-phase input transformer, but the modulation can be reduced to any desired value by the use of a d.c. reactor. The d.c. reactor also reduces the amount of higher frequency current that is reflected back into the supply system.

### *Operating Characteristics*

The frequency at which a self-excited cycloinverter operates is largely determined by the resonant frequency of the load and the power factor of the induction furnace coil. It is also dependent upon the amount of phase shift between the output voltage and the applied grid voltage, and the relative magnitudes of the grid bias and the grid a.c. voltage.

During a melting cycle, the impedance of the induction furnace coil is continuously changing and the resonant frequency changes as the impedance changes. With a constant frequency power supply, it is necessary to switch in extra capacitors to maintain a constant resonant frequency and maximum power factor. However, the output frequency of the self-excited cycloinverter shifts automatically to compensate for changes in load and maximum output power factor can be maintained without attention to the controls.

### *Power Factor*

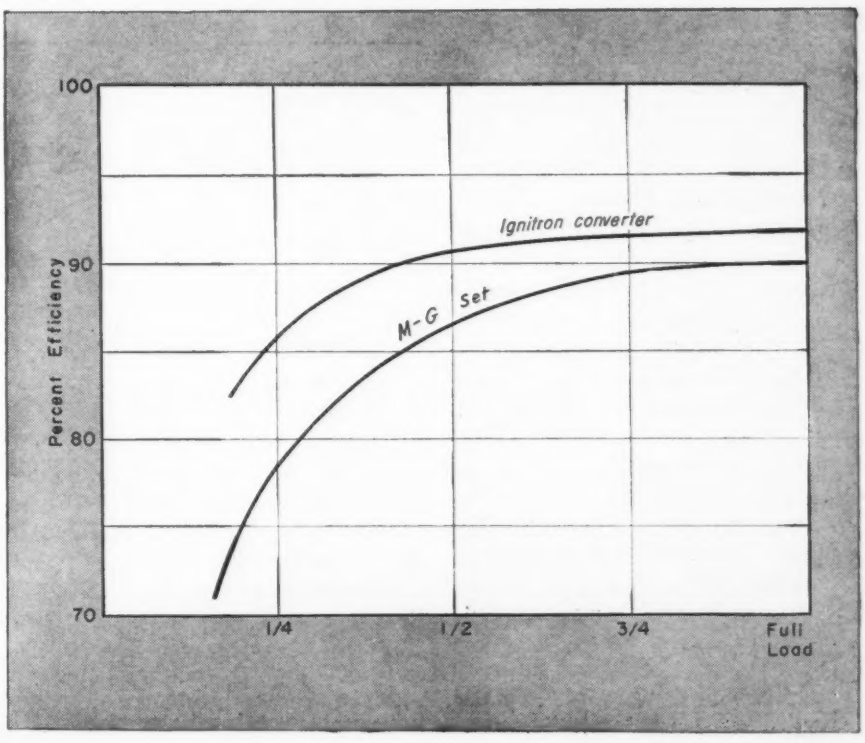
It would, of course, be desirable to obtain 100 percent power factor in the output, but this is impossible with this type of circuit. However, a bad power factor in the output is not reflected back to the input, since the cycloinverter is incapable of transferring reactive power. The input power factor conforms to that of conventional rectifiers. For a three-phase circuit it would be about 78-80 percent, and for a six-phase circuit it would be about 90-92 percent.

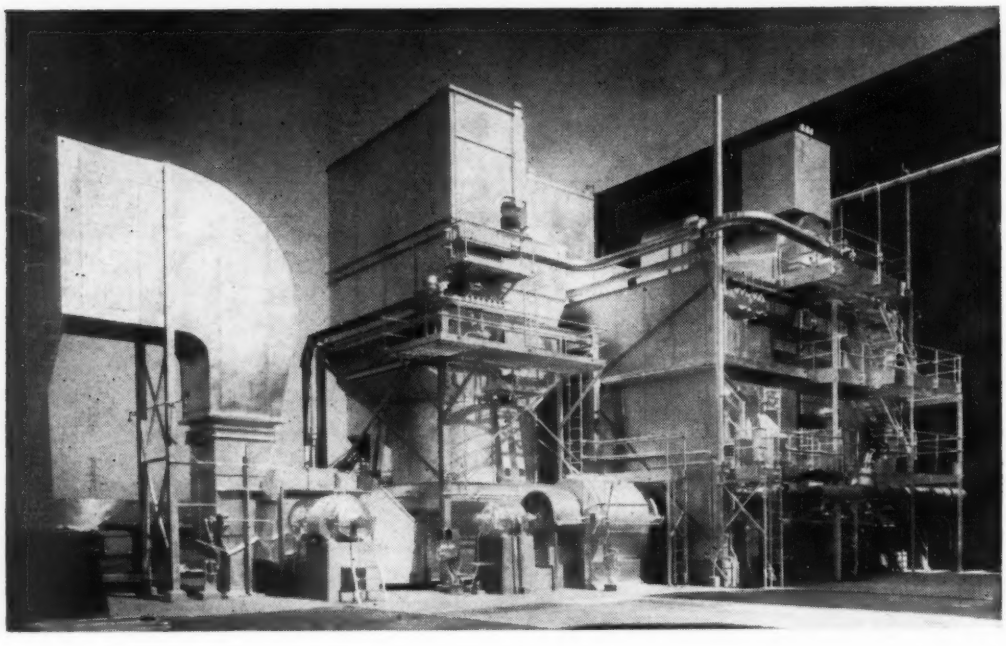
The cycloinverter with a self-excited grid circuit is inherently fault correcting. The occurrence of a fault short circuits the output and thus the grid a.c. voltage is reduced to zero, leaving only negative bias voltage on the grids. The fault current remains in the tube until the 60-cycle voltage becomes negative, at which time conduction stops and the negative grid voltage prevents further conduction in any tube. Thus, when a fault occurs, the self-excited cycloinverter ceases to operate, and the a.c. breakers remain closed. By means of relays, the cycloinverter can be put back into operation automatically. Correction of a fault and resumption of operation require such a short time that the interruption of power flow is hardly noticed.

Curves of efficiency versus load are shown in Fig. 2 for a 500-kw., 960-cycle, 800-volt MG set with a synchronous motor drive and a 500-kw., 960-cycle, 800-volt cycloinverter using ignitrons. The cycloinverter at full load has an efficiency of 92 percent compared to an efficiency of about 89.5 percent for the MG set, and efficiency remains above 90 percent down to one-half load and less.

If the over-all efficiency, which includes standby losses as well as losses under load, is considered, the advantage in efficiency for the cycloinverter is greater. If a melting furnace is the load, the power is shut off when the molten metal is poured from the crucible. During this time, the MG set continues running, since the starting kva. demand exceeds the normal kva. by several times. If a cycloinverter is supplying the load, it can be shut down while pouring, since its starting kva. demand will never exceed the normal rated kva. During standby the losses for a 500-kw. MG set will be about 25 kw., while for a cyloinverter it will only be about 3 kw. The 3-kw. loss of the cycloinverter is consumed by the circulating water pump for tube cooling.

FIG. 2—Efficiency versus load for a 500-kw., 960-cycle synchronous motor drive MG set and an equal rated ignitron cycloinverter





Semi-outdoor boiler. A shelter over safety valves (upper right) is provided for maintenance personnel

# Convenience in Operation Features Plant Extension

F. C. JUSTICE, ENGINEER
Dallas Power & Light Co.
Dallas, Tex.

DESIGN relatively new at that time was incorporated in the original installation at the Mountain Creek steam electric station in 1938. The station was designed and constructed along simple economical plans utilizing steam at 650 psi., 825 F. and with the boilers installed outdoors with enclosed firing aisle. This design was well proven prior to the installation of the second 30,000-kw. unit. In the 1945 extension of this plant, the initial design was followed closely with particular attention and study being given to the best possible arrangement of equipment and the incorporation of latest progressive ideas.

The single 300,000-lb. per hr. capacity boiler purchased for the 1945 extension did not possess adequate steaming capacity for the new 30,000-kw. net capability turbine-generator unit. The original and extension units were interconnected by the saturated and superheated steam, boiler feed water and condensate systems. These connections made available the full capacity of the 400,000-lb. per hr. boilers installed in 1938 and utilized an existing turbine-driven boiler feed pump for the three boilers.

In accordance with latest modern design, the turbine generator was specified for a speed of 3,600 rpm. and hydrogen generator cooling.

### *Convenience for Personnel*

Perhaps the most striking examples of design progress in the extension are the gage and control boards and panels (next page). These panels were carefully and painstakingly laid out for the most convenient utilization by the operating personnel. Symmetry of layout was achieved wherever possible but never at the expense of best arrangement of instruments. The sequence of operations by the operator was studied and the instruments grouped accordingly.

In the basic layout of the control boards the recording instruments were located with their centers about 5 ft. from the floor. This places the charts at about eye level and no stooping is required to observe or to change charts. Pushbuttons, annunciators and hand controls were arranged below these recorders while indicating instruments were grouped above. The closely grouped electrical controls and instruments were separated from instruments that might leak water by the use of steel compartments or shelves behind the face of the board to prevent damage to electrical apparatus resulting from water contact.

### *Main Turbine Board*

On the main turbine control board the instruments associated with the initial turning or starting of the generating unit were located on the side

***Extension of semi-outdoor station built in 1938 has refinements contributing to operating convenience . . . Color and lighting of control boards, centralized operating positions, air conditioning among improvements . . . Second 30,000-kw. unit added***

of the board nearest the turbine steam inlet valves. This group consists of the pushbutton controls for the steam header valves. speed recorder, condensate flow and vacuum gage. Indicating steam pressure gages for various points were placed at the top of the board, with a clock, electrical load indicator meter, and synchroscope located immediately below and in the center of the board. Two outlet grills from the air-conditioning system were located at the very bottom of the board. (See below).

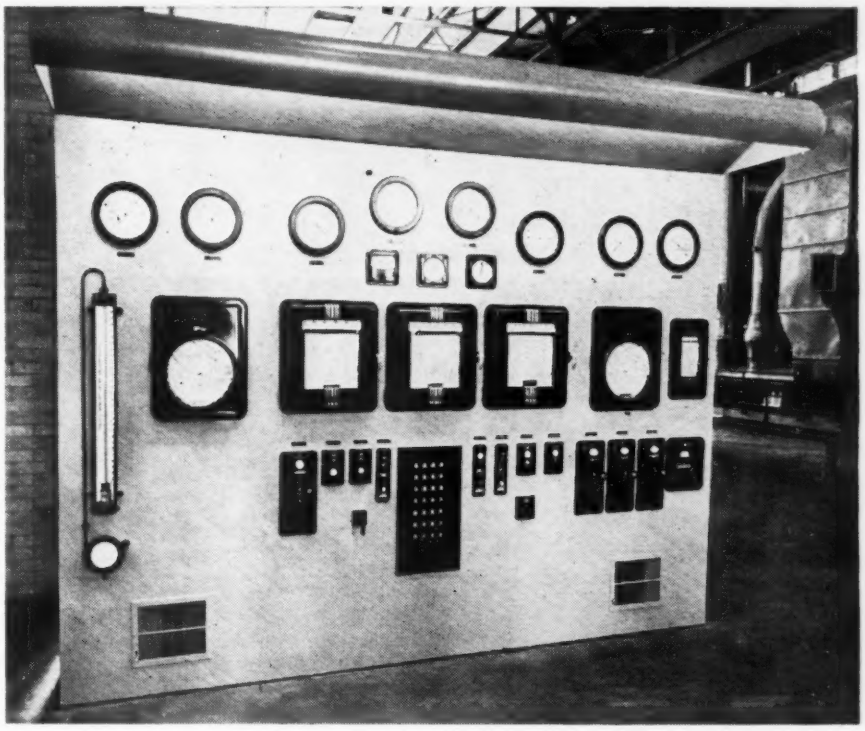
The boiler control board was laid out following the same basic arrangement with the manually operated forced draft fan vane control, steam pressure indicating gages, draft gages and boiler meter and steam temperature recorders located within 5 ft. of the manually controlled fuel valves. (See following page).

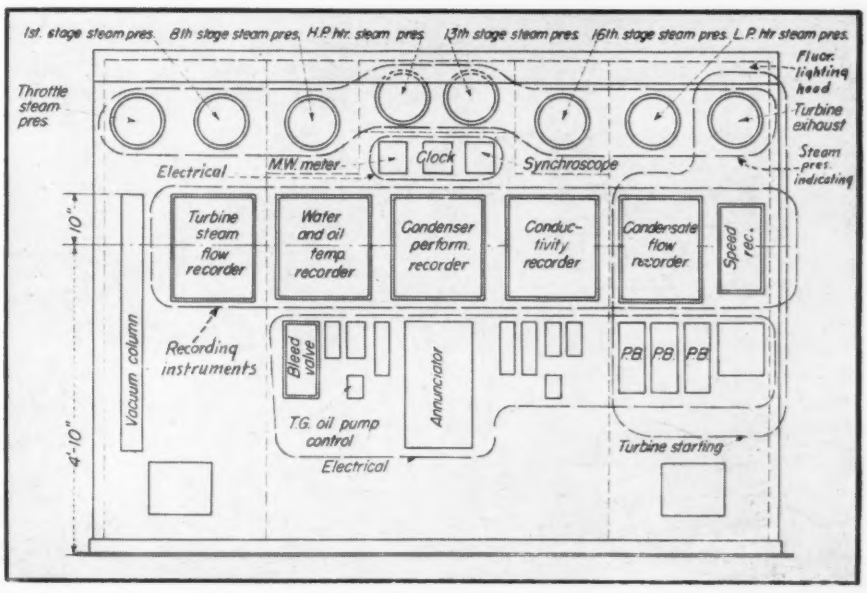
In accordance with latest practice all panels were painted gray inside and outside. The black outlined instruments and nameplates provide excellent contrast and hood-shielded fluorescent lighting fixtures contribute to legibility and lack of glare.

### *Fluorescent Lighting*

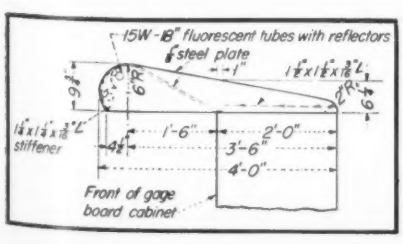
The design of the fluorescent lighting hoods was made very simple so that the light gage metal could be formed on the job site and so that easily procurable electrical fixtures and accessories could be used. A test section of fluorescent lights was assembled and temporarily attached to one of the control panels to determine the dimension proportions finally adopted. This arrangement utilized a double row of fluorescent lights placed to minimize glare and reflection. (See below).

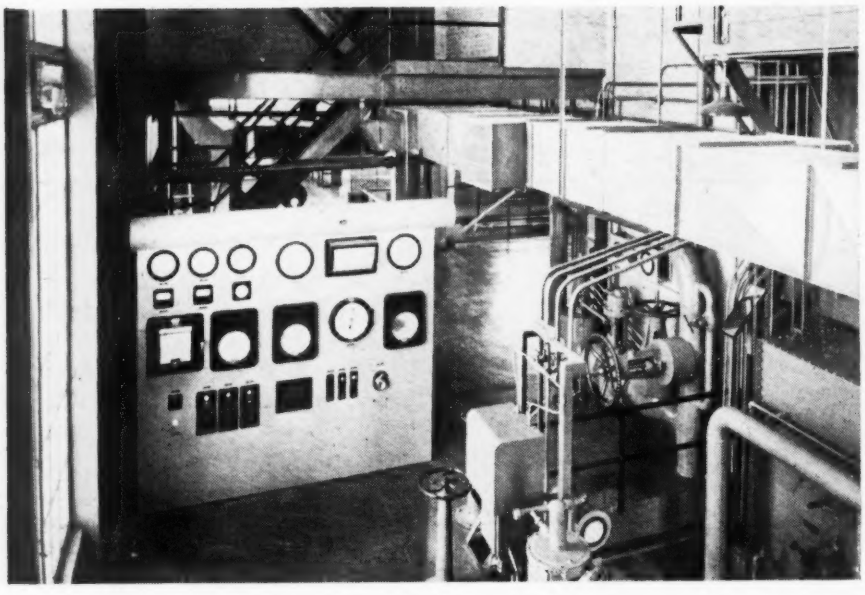
In addition to being applied to gage board illumination, fluorescent lighting was used in the laboratory and control rooms. This lighting was designed to give a high level of illumination without glare or shadow. The lower wattage required, when compared to incandescent illumination of the same intensity, results in less power consumed and a lower burden

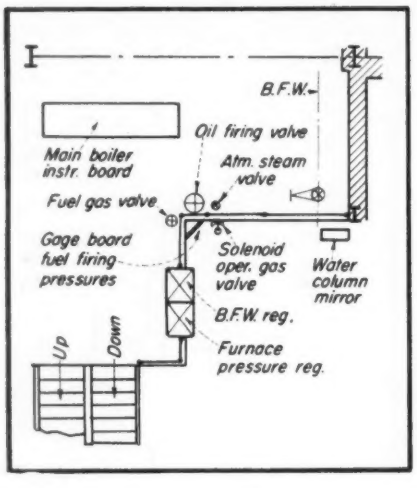





CONTROL BOARDS with gray paint, black outlined instruments and fluorescent lighting are legible and without glare. The main turbine board, above, right; identification of instruments and controls, right; tubes illuminate board from invisible location, below








BOILER control board (above) and water levels gage are within a few steps and (left) can be seen from all controls

on the building air-conditioning system.

The design, lighting and painting of the new panel boards was so well received that the boards installed in 1938 were made to conform to the new design and plans are under way to perform a similar conversion at an older generating station.

The main control board, hydrogen control panel and valves and indicating thermometers for regulating cooling water for the hydrogen coolers were grouped about the turbine generating unit. This arrangement relieves the travel requirements on the turbine engineer and he can still see into the electrical control room and boiler firing aisle from his point of vantage.

The boiler control board and controls were so compactly arranged that the fireman has the control board, fuel gas valve, fuel oil valve, automizing steam valve, solenoid operated gas valve, feed-water regulator and bypass valve, water level mirror positive indicator and furnace draft regulator within a radius of 6 ft. about a central operating point. In addition the fireman can see his boiler burners, the turbine generator unit, and has quick access to the burners, water column, and blow-down valve. (See left). This boiler firing arrangement was so designed that, with the next boiler addition, the boiler control board can be extended and only one fireman required to operate the two boilers.

Care was taken so that frequently used valves and controls were placed on most convenient locations and floor levels for the operating personnel. For instrument connections copper tubing was used wherever possible for pressure and vacuum service and inexpensive bar stock valves substituted for complex manifold valve units that had required excessive maintenance in the past.

### *Semi-Outdoor Boilers*

Trouble had been experienced with simmering of drum safety valves on previously installed outdoor boilers. These valves had been protected with light metal covers but cold winds and rain caused warping of the valve seats and resultant steam leakage and simmering. The new boiler was installed with the boiler drum safety valves protected by a steel angle frame covered with transite about 4 ft. by 4 ft. by 6 ft. high inside (1st page). As most of the boiler maintenance is performed during the colder months, this house provides an excellent shelter for the maintenance personnel and results in a more satisfactory maintenance job.

In conformity with the design adopted in 1938, the entire building is air conditioned. The necessary air from outside the building is passed through a mechanical oil bath filter, then over cooling coils supplied with cool water from the Mountain Creek Lake. Blowers force the air through a duct system to outlet grills located to give the most effective relief to personnel and equipment. During the winter months the air is heated in the duct systems by the use of steam coils supplied from the boiler saturated steam system.

### *Floor Construction*

Special treatment was given to the concrete floors for the new extension. The rough concrete sub-floor was poured in the early part of the building construction and the finish floor placed after all equipment had been grouted into place. Before placing the finish floor the sub or rough floor was chipped with an air hammer. The finish floor was placed and surface hardener and coloring added and then machine finished. After the floor had set it was machine scored into regular squares, then waxed and polished. This resulted in a beautiful and durable surface that is easy to maintain and will stand severe loads and wear imposed by operating and maintenance operations. (See illustrations on next page).

Particular attention and detailed study were given to the installation of walkways, ladders, lifting beams and associated structural items. Each location was given individual thought and attention and a simple, inexpensive, durable design adopted that would best serve the purpose.

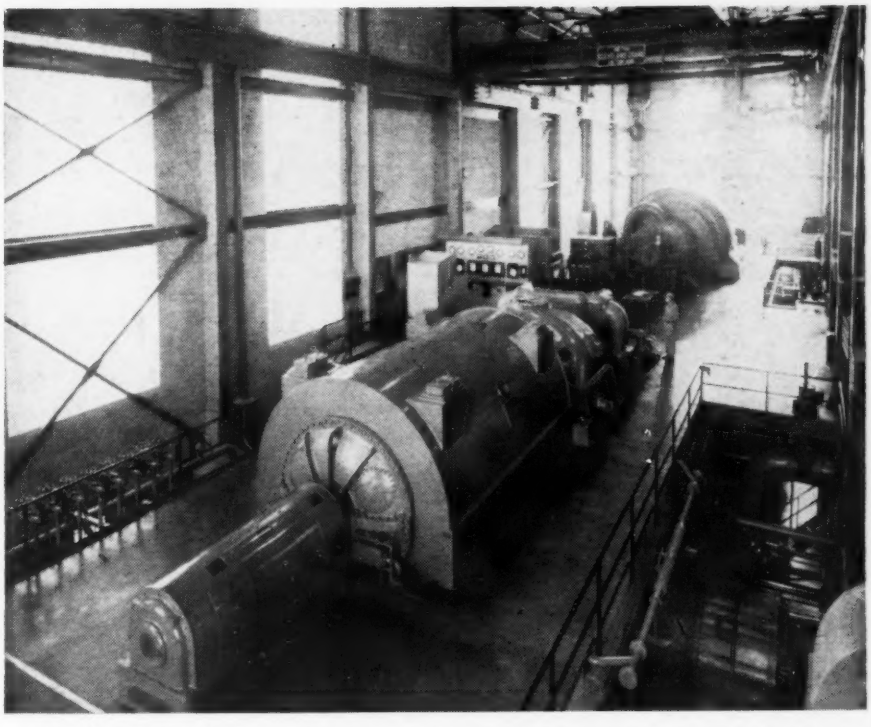
### *Electrical Features*

Electrical features not included with the previous design include fan and pump motor overload relay indicators connected to annunciators, nitrogen sealing for the 13/60-kv., 10,000-kva. step-up transformers and

a temperature recorder for the generator rotor. In keeping with the most modern trend, the 69-kv. oil circuit breakers are pneumatically operated rather than solenoid actuated as in the past. A relay was provided to close a solenoid operated butterfly valve in the main fuel gas line to the boiler, thus preventing the boiler being filled with unburned gas in case of the loss of the induced draft fan.

A 30,000-kva., 13/60-kv. transformer bank was installed with the generating unit. In order that these oil-insulated self-cooled transformers might have their capacity increased to 40,000 kva., auxiliary oil coolers were installed utilizing cooling water from a pump supplying the generating unit oil coolers, hydrogen coolers and building air-conditioning cooling coils. The cooling water has a constant flow through the transformer oil coolers. When the transformer oil temperature reaches a predetermined valve a thermostatically controlled switch starts a motor driven pump that circulates the oil through the cooler until the temperature has been reduced the desired amount. Each of the single phase 10,000-kva. transformers has its individual cooler. circulating oil pump and thermostatic switch.

The large power transformers were installed with a fixed water spray fire protection system. A sub-base rock-filled drain area was provided to quench possible burning oil and a sub-drain was constructed to convey the resultant oil and water mix to a safe location. Due to the constant attendance of operating personnel at this station the water spray system is manually controlled without automatic indicators or actuators.



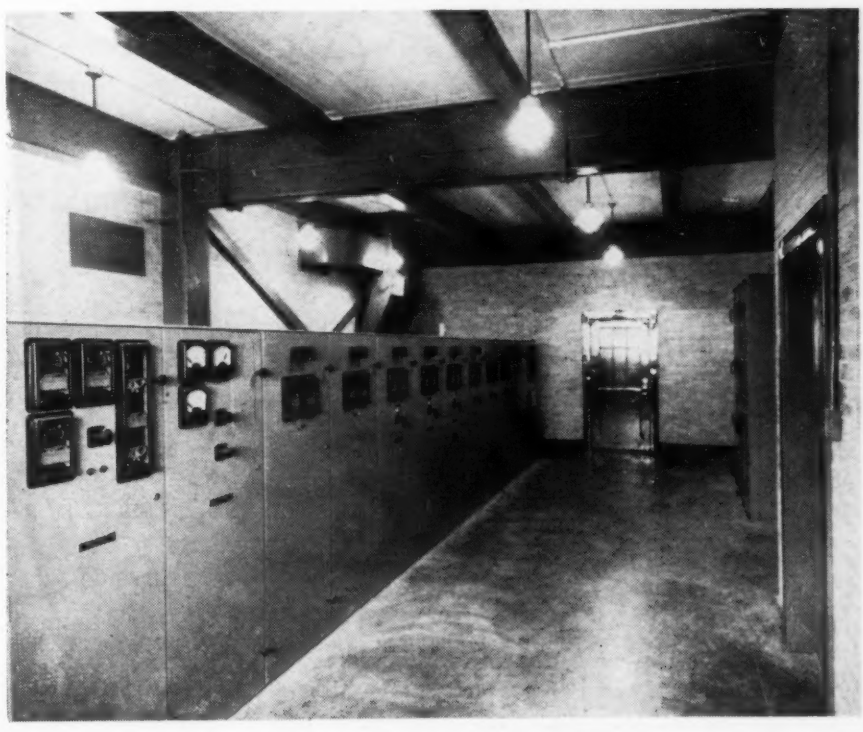
TURBINE GENERATOR operating floor with new unit in foreground. Special treatment was given to the concrete floor

### *Station Auxiliaries*

All auxiliary motors of 100 hp. and above are operated at 2,300 volts while those below that horsepower are designed for 440-volt operation. The 2,300-volt auxiliaries are supplied from a single-bus, metal-clad switchgear assembly having magnetic breakers of 100,000-kva. interrupting capacity (right). The compact metal-clad, 440-volt auxiliary distribution center is located in the same room as the 2,300-volt cubicles. Bus compartments of both voltages were painted inside and outside with a nonglare light gray color, as control boards.

All station auxiliaries are motor driven with the exception of one turbine drive boiler feed pump installed in 1938. Normally the auxiliaries for each generator unit and its boiler capacity are supplied from a 2,000-kva., 13/2.4-kv. station auxiliary transformer directly connected to the generator leads. The 440-volt auxiliaries are supplied by additional transformation from this 2,400-volt bus. Each unit can be started and operated from the transmission bus by the utilization of 2,000-kva., 60/13-kv. standby auxiliary transformer.

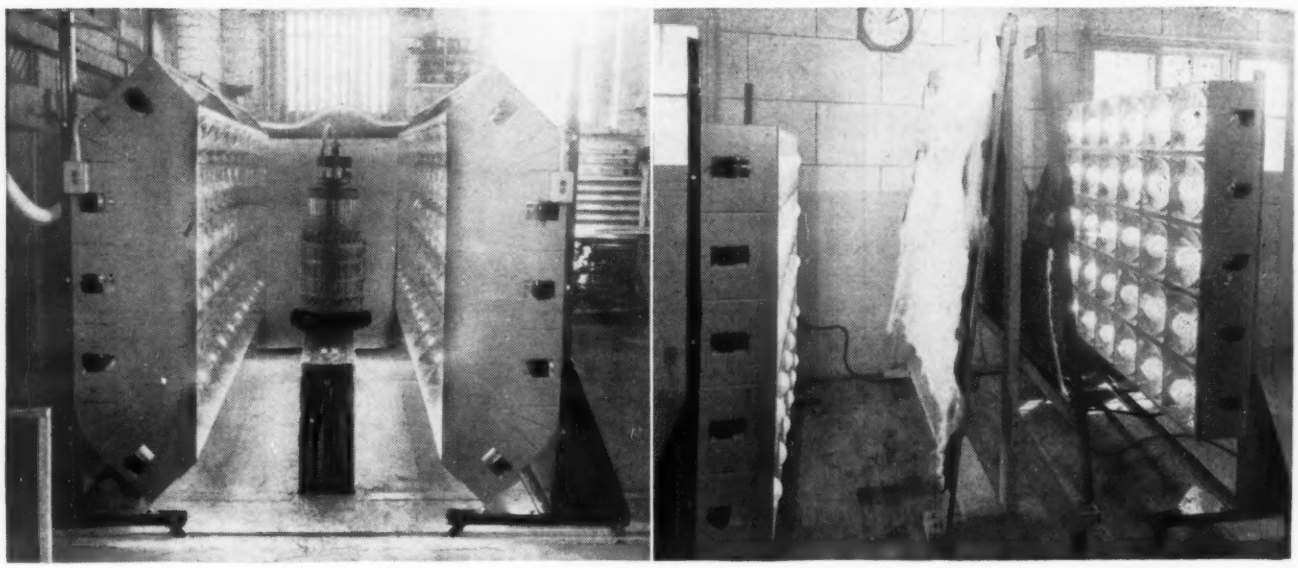
SINGLE-BUS 2,300-volt switchgear for 100-hp. and larger auxiliaries (at left) and 440-volt cubicles for smaller motors (at right) are in non-glare light gray color



# HOW

**DESIGN • CONSTRUCT • OPERATE • MAINTAIN**

## Infrared Drying Used in Two Special Applications



VERSATILITY of infrared drying is shown in the two applications illustrated which have been made in Omaha, Neb.

Novel feature of the first application shown is the remote control of the two banks of eighty 375-watt lamps each. Both banks can be raised or lowered or moved forward or backward as required for the repaired parts. The installation dries four street car armatures at one time, in less than two hours.

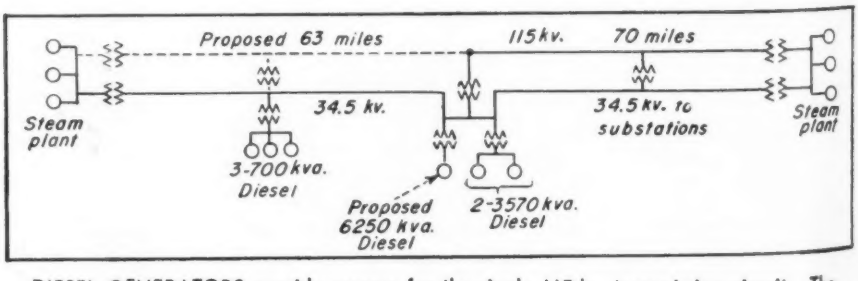
In the second installation (right) animal hides are processed for use of the hair. Infrared has replaced drying on outdoor racks exposed to the sun. Two banks of thirty 125-watt lamps enable the plant to operate continuously without regard to weather conditions.

• • •

## Diesel Generation Provides Peak and Emergency Capacity

**J. W. HOWE**
Asst. Electrical Engineer
Iowa Electric Light and Power Co.
Cedar Rapids, Iowa

PEAK LOAD CAPACITY as well as emergency reserve is provided by diesel engine generation at two outlying substations supplied by transmission lines from the steam plants of Iowa Electric Light & Power Co. Operation of two 3,570-kva. units installed in 1942 has been so satisfactory that an additional 6,250-kva. generator is now planned to supplement a new transmission interconnection, as shown in the accompanying diagram.




DIESEL GENERATORS provide reserve for the single 115-kv. transmission circuit. The subtransmission circuits at 34.5 kv. are for local distribution substation supply

Rapid load pick-up is a feature of the diesel engine. Automatic starting and field control bring the generator up to full voltage and the units are synchronized and carrying load in less than one minute after a pushbut-

ton signal by the operator. This is accomplished by momentarily cutting the fuel supply and operation of the generator as a motor, after the engine is brought up to speed.

While diesel generation is more costly than steam for normal supply, the arrangement is amply justified by the investment saving compared to additional transmission and is less expensive than an equivalent steam standby plant. The local generation can carry all of the distribution load in the adjacent area in an emergency. The normal operation is on a schedule for peak load periods, as during certain hours of Monday and Tuesday and on extremely dark days.

• • •

## Lessons of a High-Tension Substation Fire

AT AN EASTERN power company's outdoor substation an electrical breakdown occurred in the afternoon in the middle transformer of a bank of three 16,250-kva. units, because of a defective bushing and cracked retainer clamp on a 14-kv. lead located about 18 in. below the surface of the insulating oil. This permitted moisture to enter the transformer and provide a low resistance path to ground.

About 3 in. of this 1-in. solid copper lead inside the transformer was fused and distributed copper and solder globules throughout the windings. The explosion vent disc ruptured and burning oil was violently expelled from the vent. A hot oil fire ensued, damaging the entire bank as well as lightning arresters, switchgear bushings, buses, insulators and the steel structure above the transformer and circuit breaker units.

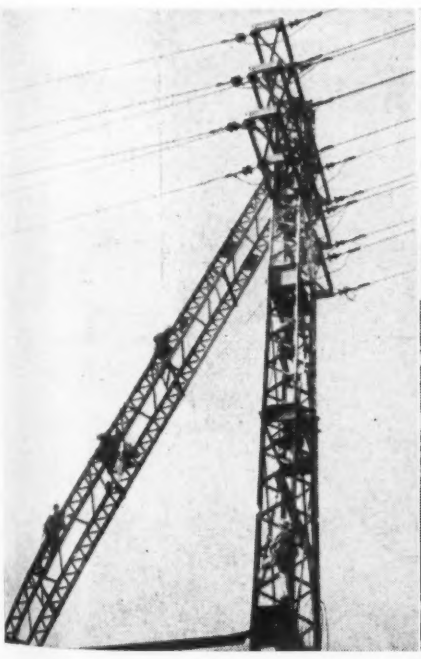
Leaks developed at the radiator gaskets of all the transformers in the bank, adding fuel to the fire. Service from the station was interrupted for only 10 min., despite the fact that fresh water from a hose stream entered a control terminal box in the switch yard, tripping circuit breakers controlling another bank. The total estimated damage exceeded $80,000.

The principal lessons of this fire were to protect the transformers by a permanently piped water spray system, with nozzles supplied from a pump taking suction from a large reservoir near the substation; to provide hydrant protection with fresh water supply; and to use crushed stone as a covering for the concrete transformer mat. Crushed stone in the substation yard prevented the wider spread of the oil fire and damage to other adjacent electrical equipment.

• • •

## Steel Towers Reconditioned for $67 a Ton

H. G. SILLIMAN • Senior Engineer, Seattle City Light



FLAME CLEANING steel towers proved most satisfactory method of preparing surfaces for recoating. Left, working on a 250-ft. tower. After flame cleaning and wire brushing, towers were given solid red lead prime coat, a solid aluminum-in-varnish coat and an aluminum and international orange stripe coat. Right, oxygen acetylene tanks, manifolding and pressure regulating equipment

FACED with the problem of reconditioning and painting four groups of high-voltage waterway crossing towers, Seattle City Light had the more detailed problem of how best to clean the steel preparatory to resurfacing. Surfaces of the towers, which had not been painted for a number of years, ranged in condition from poor to good.

Two groups of towers in good condition were wire brushed, red lead spotted and then given one solid coat of aluminum-in-varnish and a stripe coat of aluminum and international orange. A group in fair condition which had originally been painted with a red lead shop coat and an aluminum bituminous base finish coat were more difficult to prepare. After some experimentation it was decided to burn the badly rusted areas with an oxy-acetylene torch, using the No. 110 round brush tip; then wire brush and red lead spot. An attempt to burn the bituminous base paint did not

prove successful because the paint became gummy and flowed under the torch.

Three towers in poor condition were badly rusted all over and required complete surface preparation. After numerous tests and investigation a decision was made to flame clean these towers. The painting contractor procured four flame cleaning equipments, consisting of the No. 120 flat brush multiple flame tip, 4 in. wide, tip holder, rubber hose, pressure regulating valves and tank manifolding fittings, as shown. Two of the main towers were about 250 ft. high and the anchor tower was 105 ft. high. The flame proved very effective in charring the remaining old paint and in cracking the rust loose. Two or three passes with a wire brush then produced a clean surface.

The recommended procedure for flame cleaning calls for painting while the steel is still hot, but owing to the difficulty of passing up and down the towers this was practically impossible. However, the paint was applied promptly after wire brushing while the steel was still somewhat above ambient temperature. These towers were then given a solid red lead prime coat, a solid aluminum-in-varnish coat and an aluminum and international orange stripe coat.

The labor and material cost per ton of flame cleaning and red lead priming on the 44-ton main tower was approximately $48, and the cost of the two finish coats was $19, making a total of $67. The contractor undertook the flame cleaning method with some misgivings but was thoroughly sold on it before the job was over. It is doubtful whether any other cleaning method except possibly sand blasting would have done as good a job as the method outlined.

• • •

## How Many Men on a Hot Line Job?

A MINIMUM NUMBER of workmen required to work on energized wire and equipment has been established by Portland (Ore.) General Electric Co. The number of employees and the conditions are outlined in this adaptation from the company's safety rules.

Two competent electrical workers shall be required on the same pole or structure when performing work on wires or equipment operated at voltages in excess of 750 volts. One of them shall serve principally as a standby man to render assistance in avoiding accidents. In no case, where working in pairs, shall they work simultaneously on wires or parts of different polarities or phases.

When two poles are near enough together to permit a man to go from one pole to another without first going to the ground, they shall be considered one pole or structure. The only exceptions to this rule are as follows; (a) Fusing transformers; (b) Opening or closing switches.

In cases of emergency where danger to life or property would be aggrevated by delay, one may clear the hazard without assistance.

In districts in which only one qualified man is regularly employed, it is usually possible to deenergize circuits for a short period without serious interruption of the service.

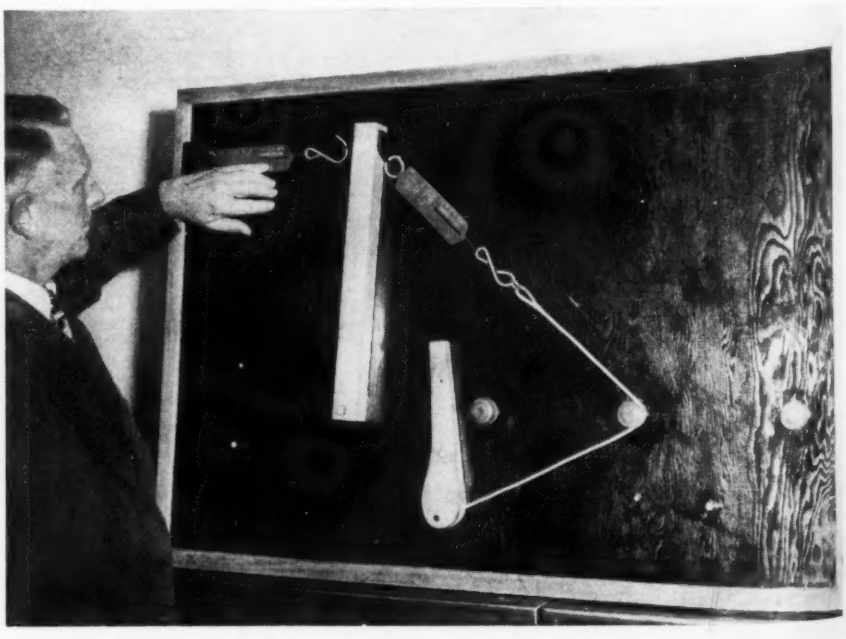
If the district in question is of so little importance that the maintenance of the second man would be impractical, then deenergization is the only practical solution and shall be the only alternative to the two-man rule.

Not less than three men shall be employed when installing or removing transformers on poles or structures.

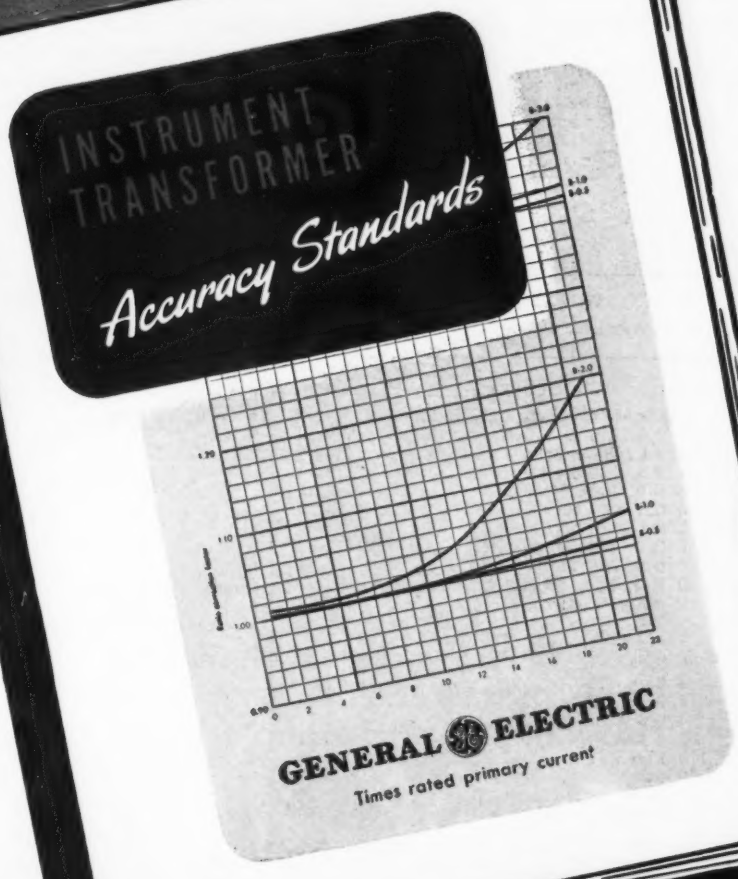
• • •

## Model Explains Guy Tensions

TENSION in guys in relation to pull of line wires is illustrated on this simple demonstration board used in utility's training classes for estimators. Purpose is to show visually that with a given pull of line wires, tension in ground guys varies when anchors are placed at different distances from the pole. The square piece of wood, hinged at the lower end, represents the pole. A pair of inexpensive scales is used, one in what would be the line wires and the other in the guy so that tensions may be read directly in pounds. Pegs are placed on the board so that the simulated guy may be placed at 60, 45 and 30 deg. Tension is applied by the cam-type lever shown. The demonstrator was made up by T. A. Bettersworth at the suggestion of C. E. Baugh, (shown) both of Pacific Gas and Electric Co., San Francisco, Calif.



# Ready!

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# Chart Determines Pole Size Required for Transverse Load

**Complicated calculations of transverse load and pole size are reduced to determination of equivalent wire load with the accompanying chart. All wire sizes are converted to an equivalent number of No. 6 bare copper using multipliers from the table below.**

F. A. KENDIG • Transmission and Distribution Engineer, Dayton Power & Light Co., Dayton Ohio

## INSTRUCTIONS FOR USE OF CHART

ENTERING the chart along the sloping line corresponding to the wire equivalent, project horizontally from its intersection with proper span length ordinate to read transverse load on the right hand scale. Reference from this load to the factor of safety being used gives the required pole size.

**EXAMPLE:**

For 4 No. 2/0 H.D. Bare and 3 No. 2 D.B.W.P. solid wires, 250-ft. span.

Wire equivalents total = 8.48

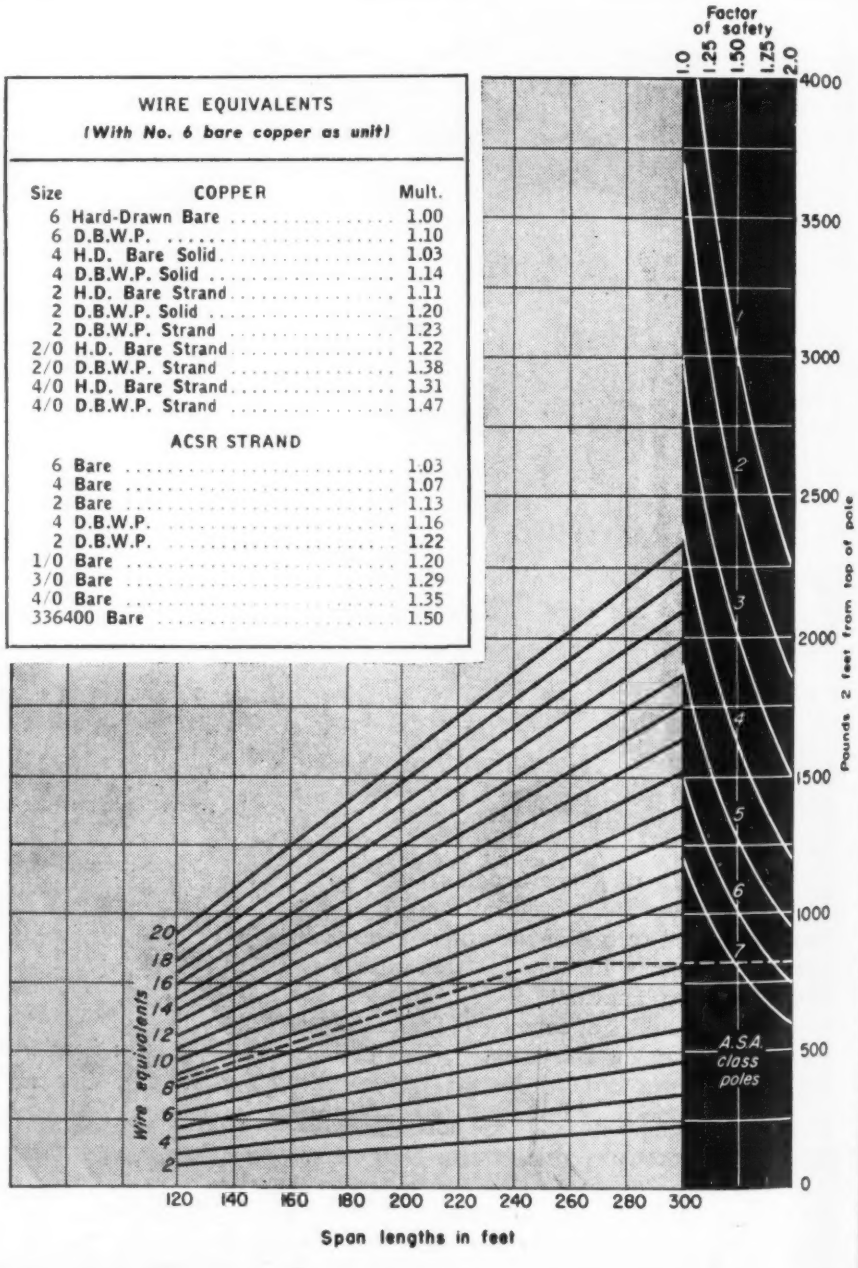
Transverse load for 250-ft. span = 820 lb.

For factor of safety 1.5
Class 7 pole

For factor of safety 2.0
Class 6 pole

WIRE EQUIVALENTS
*(With No. 6 bare copper as unit)*

| Size | COPPER | Mult. |
|---|---|---|
| 6 | Hard-Drawn Bare | 1.00 |
| 6 | D.B.W.P. | 1.10 |
| 4 | H.D. Bare Solid | 1.03 |
| 4 | D.B.W.P. Solid | 1.14 |
| 2 | H.D. Bare Strand | 1.11 |
| 2 | D.B.W.P. Solid | 1.20 |
| 2 | D.B.W.P. Strand | 1.23 |
| 2/0 | H.D. Bare Strand | 1.22 |
| 2/0 | D.B.W.P. Strand | 1.38 |
| 4/0 | H.D. Bare Strand | 1.31 |
| 4/0 | D.B.W.P. Strand | 1.47 |
| | **ACSR STRAND** | |
| 6 | Bare | 1.03 |
| 4 | Bare | 1.07 |
| 2 | Bare | 1.13 |
| 4 | D.B.W.P. | 1.16 |
| 2 | D.B.W.P. | 1.22 |
| 1/0 | Bare | 1.20 |
| 3/0 | Bare | 1.29 |
| 4/0 | Bare | 1.35 |
| 336400 | Bare | 1.50 |



# SUBSTATIONS

## with your load

The new package substations give a valuable flexibility to operators who must supply today's growing loads and prepare for tomorrow's.

This flexibility—illustrated at the left—is achieved by forward-looking designs that provide substation capacity in easily installed, easily moved "blocks of power." It enables you to:

1. **Be ready for expected—or unexpected—load growth or load shifts.**

Addition or re-location of package substation capacity is quick, easy and economical. There is no costly modification or rearrangement of installed equipment. The same flexibility enables you to remove capacity just as readily, to follow a shifting load.

2. **Reduce your system investment by more closely matching your installed substation capacity with changing loads.**

Cost comparisons and operating experience show that the "building block approach" of the new package substations can materially lower your system costs. Easy, economical installation of relatively small "blocks of power" enable you to make your installed substation capacity follow your load in small economical steps (right).

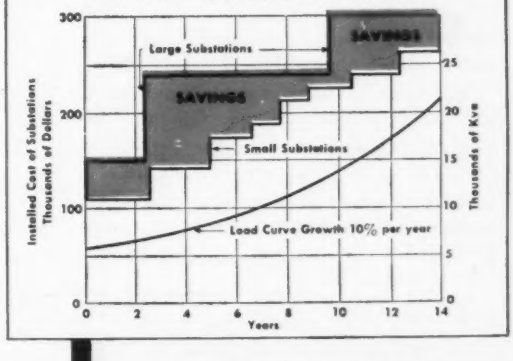
This on-the-job economy is but one of the package substation savings. Because you can select a *complete* substation as a unit, you save weeks of costly detailed planning right at the start. You go directly from the job to be done to the complete substation for the job. You need prepare but one *specification,* place but one *order.*

A helpful, 78-page bulletin, GEA-4500, describes 30 standard classes of package substations, gives you helpful application information on each, and shows just how each will look installed. If you do not have a copy, your General Electric sales representative will be glad to provide one, and work with you on any application you are considering. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

**The chart below assumes an accurate load-growth prediction—which is seldom found in practice. If load growth is erratic, the savings will usually be even greater than shown.**

**The practice of meeting load growth with relatively small "blocks of power" also insures against excessive unused capacity in event of an unpredicted drop in load. Then, any unused capacity that has been added in small "blocks" can readily be moved to meet load growth in another area.**

**HOW YOU SAVE BY ADDING CAPACITY IN SMALL "BLOCKS OF POWER"**




**SAVINGS ON SUBSTATIONS**

*(Total annual charges at 12%)*

| | |
|---|---|
| Using large substation of fixed capacity..... | $434,000 |
| Using package substations with "building block" approach..... | $330,000 |
| *Savings*..... | $104,000 |

**GENERAL ELECTRIC**

121-54-5900

# A Chart for Stringing Catenaries

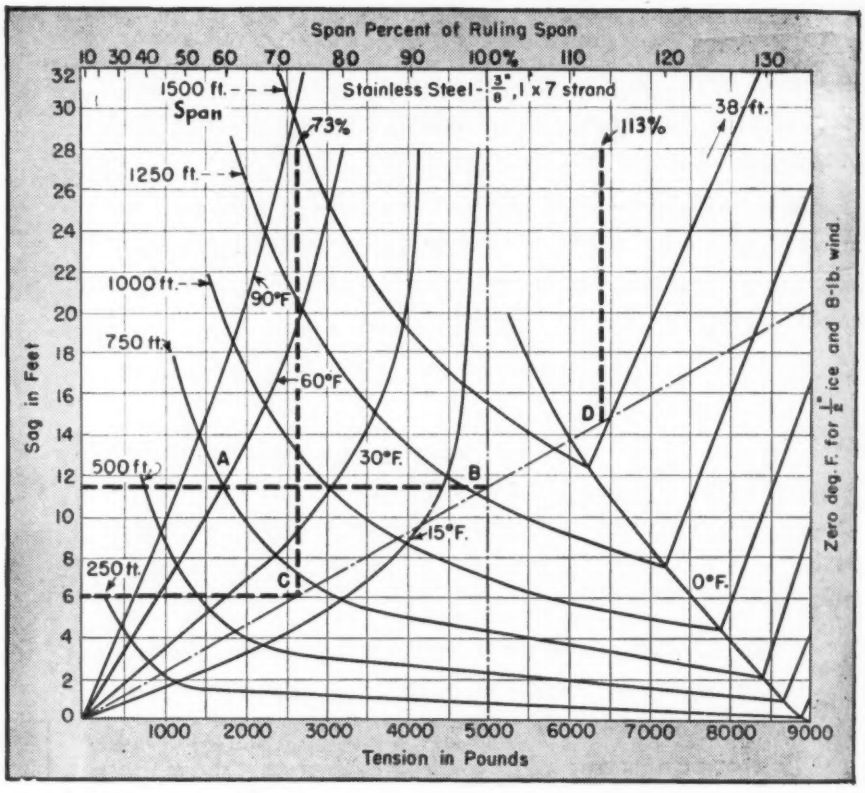
## Using Stainless Steel, 3/8-In., 1 x 7 Strand

**V. H. GODFREY**, Sales Engineer, Page Steel and Wire Division, American Chain & Cable Co., Inc., Bridgeport, Conn.

ACCOMPANYING CHART has been developed as a quick and simple means for determining in the field the tension and/or sag of the catenary to which an overhead ground wire should be strung at any temperature for any given span, to meet the standard of 50 percent breaking load tension at zero deg. F. with ½-in. ice and a horizontal wind force of 8 lb. per sq. ft. The chart can also be used when stringing to ruling span tension, giving the sag for any span of different length.

In developing these curves the sag of each span under maximum loading conditions was first determined; this sag was unloaded to merely the weight of the wire (ice and wind removed) and the length under those conditions was determined. This length was increased by use of the temperature coefficient of expansion for 30, 60, and 90 deg. F., and the span curves were plotted to coordinates of tension and sag. A slight error is introduced in that as the tension decreases, the length of strand decreases, but for the relatively small changes in tension, the changes in length are small also, and any reduction of length is immediately counteracted by a tendency to increase of tension; hence, that factor is omitted.

The sag in any span (holding a constant tension) is to the sag in any other length span as the square of the first span is to the square of the second span. Hence, the scale of squares at the top of the chart gives the sag for any percentage span of the ruling span whose sag is known. These are final sags and tensions. Strand to be strung should be pre-stressed by pulling up to 50 percent of breaking load and holding for one hour; or, if stressing in the field is necessary, the initial tension should be 10 percent more and the initial sag 10 percent less than the final tension and sag as given by the chart.




**CATENARY stringing chart for any dead-end or ruling spans and any temperature, to meet heavy loading conditions at zero deg. F., also gives sag for any span at ruling span tension**

### INSTRUCTIONS FOR USE OF STRINGING CHART

1—For dead-end spans, enter chart with length of span and temperature as arguments and pick off sag and corresponding tension. String to either of these. Do this for each dead-end span.

2—Choose "ruling span"—usually average span plus ⅔ (maximum span minus average span)—and enter chart with ruling span and temperature as arguments. Pick out sag and tension.

3—Project sag for ruling span horizontally to intersect "dot-dash" ordinate (100 percent on top scale). Connect this point with the origin. The line so resulting is the sag line for constant (ruling span) tension at any percentage of the ruling span.

### EXAMPLE

**Given:**

Page stainless steel, ⅜-in., 1 x 7 strand. Weight 280 lb. per 1,000 ft. Breaking load 18,000 lb. Average span 550 ft. Maximum span 850 ft. Temperature 60 deg. F.

**Find:**

(1) Ruling span sag and tension and (2) sag for maximum and average spans.

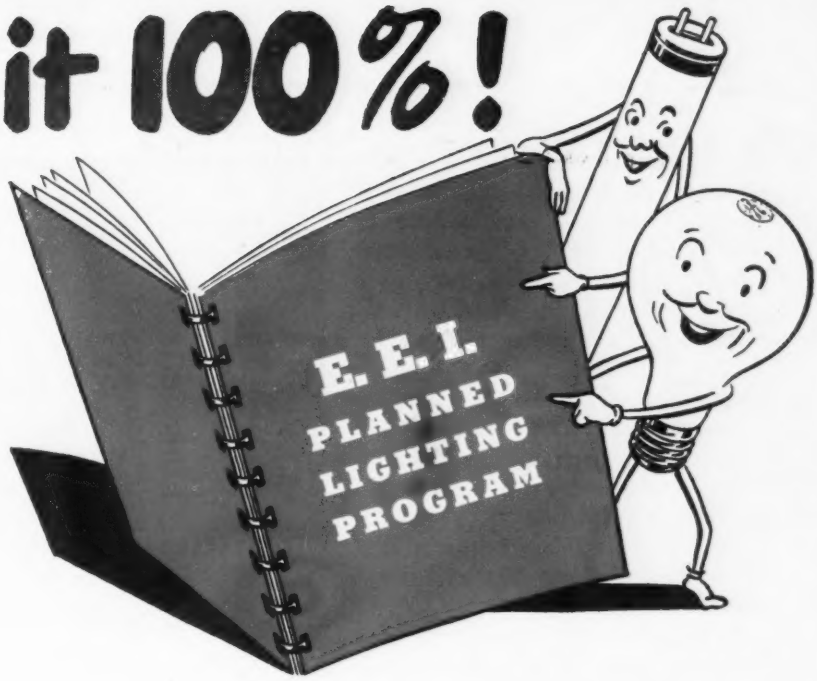
**Solution:**

(1) Ruling span = average span plus ⅔ (maximum span minus average span) = 550 plus ⅔ (850 − 550) = 750 ft. From chart, at intersection of 60 deg. F. line and 750-ft. span curve (point "A"), sag = 11.4 ft. and tension = 1,750 lb. (constant tension, all spans).

Project from point "A" over to 100 percent vertical line (point "B") and connect this intersection with origin (zero). This is the (constant tension) sag line.

(2) Referring to the top scale, average span = 550/750 = 73 percent of ruling span. Draw perpendicular line from 73 percent to (constant tension) sag line (point "C") and project horizontally to the zero ordinate to read value of sag = 6 ft. In the same manner maximum span = 850/750 = 113 percent and sag (point "D") = 14.6 ft. Similarly the sag for any other length of span at a tension of 1,750 lb. may be found from the chart.

# We're for it 100%!




General Electric salutes the Edison Electric Institute's new comprehensive Planned Lighting program for utility companies. We believe this campaign is a logical and effective means of increasing the use of better lighting in homes, stores, schools, offices and factories — that it will benefit the entire lighting industry and every consumer it serves.

## How General Electric ties in with Planned Lighting

Here are some of the ways in which the General Electric Lamp organization will support the E.E.I. program and help you increase your greatest Profit Load with Planned Lighting:

1. New developments from the General Electric Lighting Research Laboratory.
2. Cooperation of G-E lighting specialists with the educational work of the Better Light, Better Sight Bureau.
3. Expanded use of the General Electric Lighting Institute for the training of utility people and for the general stimulation of improved lighting practice.
4. Consistent nationwide lamp advertising in magazines, newspapers and spot radio.
5. Special editorial features in the Magazine of Light.
6. Up-to-the-minute engineering assistance to utility lighting departments and lighting equipment manufacturers.
7. Merchandising plans tying in G-E Lamp wholesalers, dealers and chain outlets with local utility programs.
8. Special contractor program for better lighting installations.

**IF YOU NEED** *lamp information for your Planned Lighting promotion, just call your nearby G-E Lamp office. General Electric Co., Lamp Department, Nela Park, Cleveland 12, Ohio.*

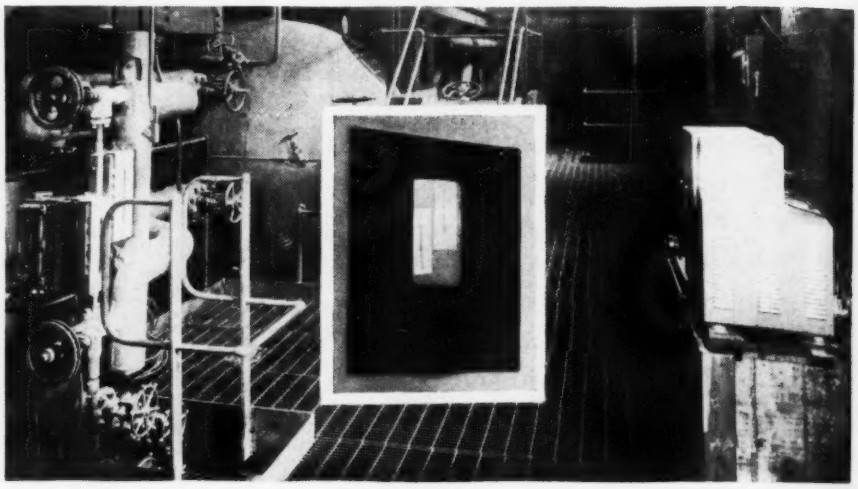
# Television Indicates Water Level in Boiler

A SIGHT-TRANSMITTING SYSTEM known as the Utiliscope has been in operation the past nine months at Hell Gate Station of Consolidated Edison Co. of New York, Inc., as a means for a direct visual surveillance of boiler gages at all times.

The Utiliscope is being used to show the water level in a boiler remotely located from the main control room. A photoelectric camera focused on the water-level gage continuously transmits the picture to a control panel where the image is reproduced on a screen similar to that of a home television receiver.

This permits observers in the control room to keep a constant check on the boiler 325 ft. away. Not only are the boiler and main control room separated by a distance greater than an average city block, but also by eight floors, a building wall and various other obstructions.

The complete installation, which weighs 121 lb., includes four units, camera with deflection unit, two small power units and the monitor or viewer. It has fewer tubes than a good radio set, and except for the camera pickup tube—the Farnsworth Image Dissector—all its electronic tubes are standard types easily available.

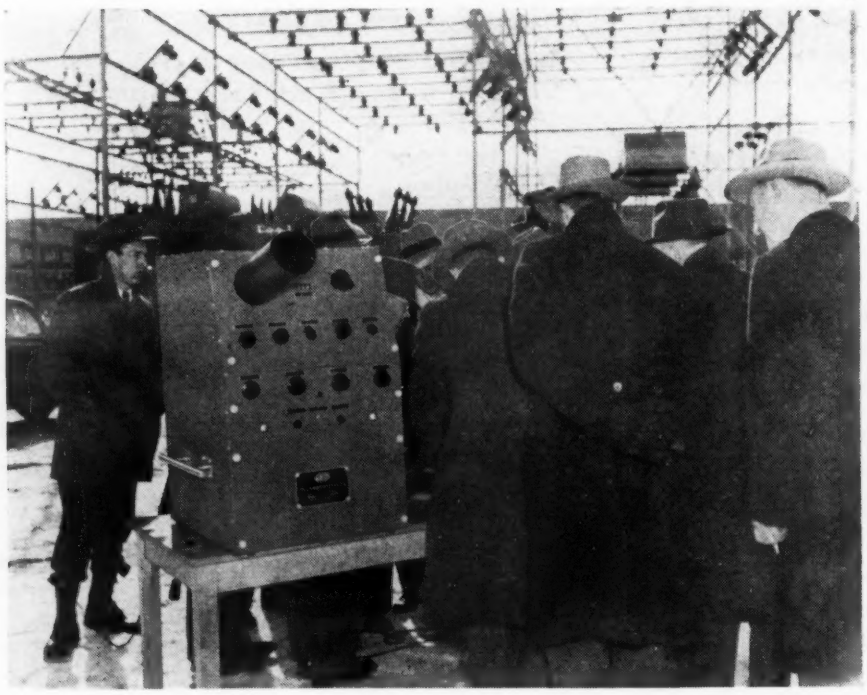


PHOTOELECTRIC CAMERA (right) is focused on boiler gages (left) and water-level condition is reproduced on television screen (inset) in main control room

Research and developmental work on the Utiliscope was conducted at the electronic laboratories of the Farnsworth Television and Radio Corp., in Fort Wayne, Ind., and the headquarters plant of the Diamond Power Specialty Corp. in Detroit, Mich.

• • •

# Improved Method of Transmission Line Fault Location



TELEMETROSCOPE set up in test at a transmission substation where the location of typical faults on a 66-kv. circuit is being demonstrated. Reflected pulses from transmission circuit appear on a screen at upper left indicate distance and characteristics of fault. The instrument also has a control dial graduated to read distance in miles to fault from point of instrument location

TO INCREASE the speed and accuracy of fault location on electric power transmission circuits. the Tobe Deutschmann Corp.. Canton, Mass.. has developed an electronic method of determining within one or two minutes after instrumental connection the nature and position of any line trouble of sufficient magnitude to operate the protective relaying system. The method is embodied in a new instrument designated the "Tobe Telemetroscope," and it is an evolution of the earlier "Telemetrograph" of this company in which an automatic curve tracer recorded the relationship of frequency and voltage appearing at the instrument terminals, connected from line to ground or from line to line, as a result of the phase relationship of outgoing and reflected waves when a voltage of continuously variable frequency was impressed on the circuit under test.

In the new instrument, the reflections due to circuit discontinuities are again employed, but voltage pulses

# *this cable won't quit when jobs are HOT!*

Wiring in high-temperature locations is vital to steady plant operation. If a power cable quits, if a control circuit fails, it may ruin a "heat" or close down a department.

For years, plant engineers with hot jobs to wire have specified Deltabeston* power cable and boiler-room wire. They recognize the practical application experience which General Electric has been able to put behind them. They know that new research is always under way.

In many cases, too, it's the selection of the right *type* of heat-resistant cable that's so important to long life. The Deltabeston line includes standards and "specials" for every combination of heat, moisture, corrosive vapor or other condition. And *men who know the problem* stand back of your Deltabeston supply source, ready to advise you or your contractor on selection. For full information on Deltabeston cables or wires for *any* hot job, write Section Y53-327, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

**Trade-mark Reg. U. S. Pat. Off.*

**GENERAL ELECTRIC**

## HI-AMBIENTS

***Practical product suggestions from your Deltabeston Distributor***

**FOR FLEXIBLE LEADS . . .** on heavy apparatus that involves hot work, such as electric furnaces, cranes handling hot metals, and the like, Deltabeston YK-2253 is a popular choice. Insulated with an impregnated wall of felted asbestos and asbestos braid, it resists heat, flame, oil and corrosive vapors up to 125 C (257 F).

**IF YOU ARE PUZZLED . . .** as to the relative merits of asbestos-insulated versus glass-insulated magnet wire for any particular application, you can get unbiased advice from Deltabeston application specialists. The Deltabeston line includes both. And for extra severe jobs, glass-insulated wire with *silicone varnish* is now becoming available. Its rating is 200 C.

**FLUORESCENT FIXTURES . . .** need heat-resistant wiring in and around the ballast. For those located in hot, humid places, *all* the wiring should be heat resistant. Why not make your installation with the same type of Deltabeston wire which ballast and fixture manufacturers use?

**WIRING JET PLANES . . .** may be a long way from your business, but the choice of a Deltabeston Aircraft Wire for this extra-severe duty helps explain why so many folks turn to us for solutions to "impossible" insulation requirements.

**DELTABESTON**
**Wires and Cables**
*Built to beat the heat*

of a few microseconds' duration are used instead of the voltage of continuously varying frequency. The reflected pulses are observed on the screen of a cathode ray oscilloscope after amplification by a high-gain receiver.

The voltage pulses are impressed on the circuit under test and are repeated at a rapid, regular rate. They travel along the circuit and are reflected by an open, a short or any other form of discontinuity in the electrical characteristics of the circuit. The sweep circuit of the 'scope is so designed that the lateral position of the reflected pulse indicates the distance from the instrument to the point of circuit discontinuity. In the present instrument, a calibrating circuit with its control dial graduated directly in miles and fractions is employed for the measurement of the distance to the fault. The linearity of the sweep circuit and the accuracy of the calibrating circuit permit the location of faults to within 0.1 mile.

### *Often Unnecessary to Clear Line Taps*

With the telemetrograph successful operation required clearing a line of all taps. With the telemetroscope, test can be made on a relatively complex circuit with one or more taps. The 'scope gives a picture of the entire circuit, including reflections from the ends of the line and from all taps. After becoming familiar with the indication normally to be expected from an unfaulted condition on his own lines, the operator can recognize abnormal conditions and quickly determine where disconnects should be operated to permit final location of the fault. Neither special skills nor mathematical ability are required in usual operation. Controls and operating adjustments are few and simple, while the direct mileage graduation of the calibrating circuit control eliminates the computations involved in the use of the earlier instrument.

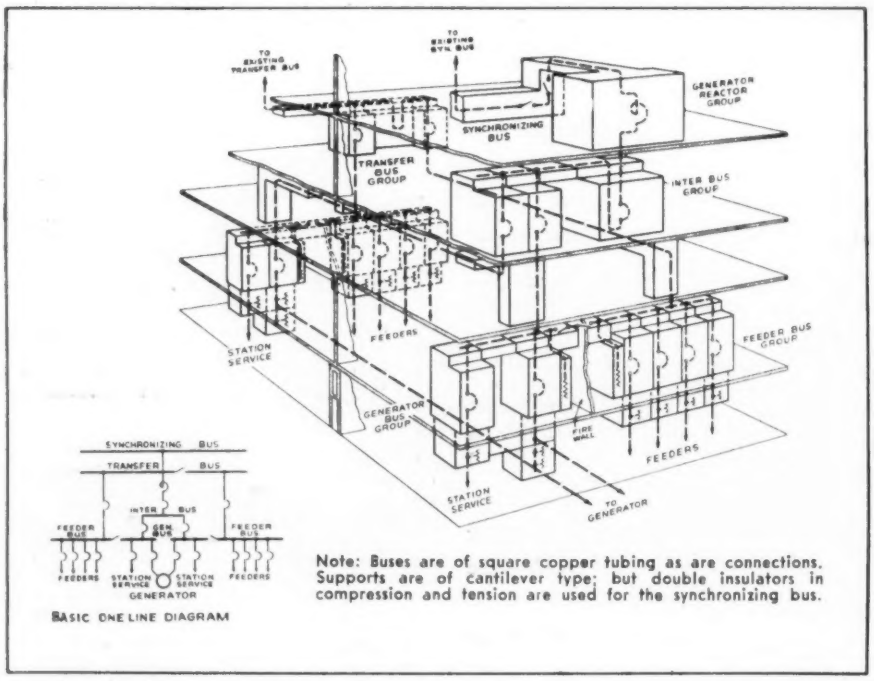
The telemetroscope can be used on lines of any length now in existence. For maximum utility and accuracy it is normally balanced for the range of line lengths on which its most frequent use is expected. It is not used on live transmission circuits, but is portable and can be placed in operation simply by connecting its power input circuit to a source of 115-volt, 60-cycle energy (about 400 watts are required) and by connecting its output cables to the circuit to be tested. No special installation provisions are required. In the construction of the instrument, standard components are used, with high safety factors against failure. Tubes are all standard, readily obtainable from radio parts distributors. The chassis mounting is on rolling channels, permitting easy accessibility for checking or renewing tubes.

• • •

# Adapting Metal-Clad Switchgear to Plant Addition

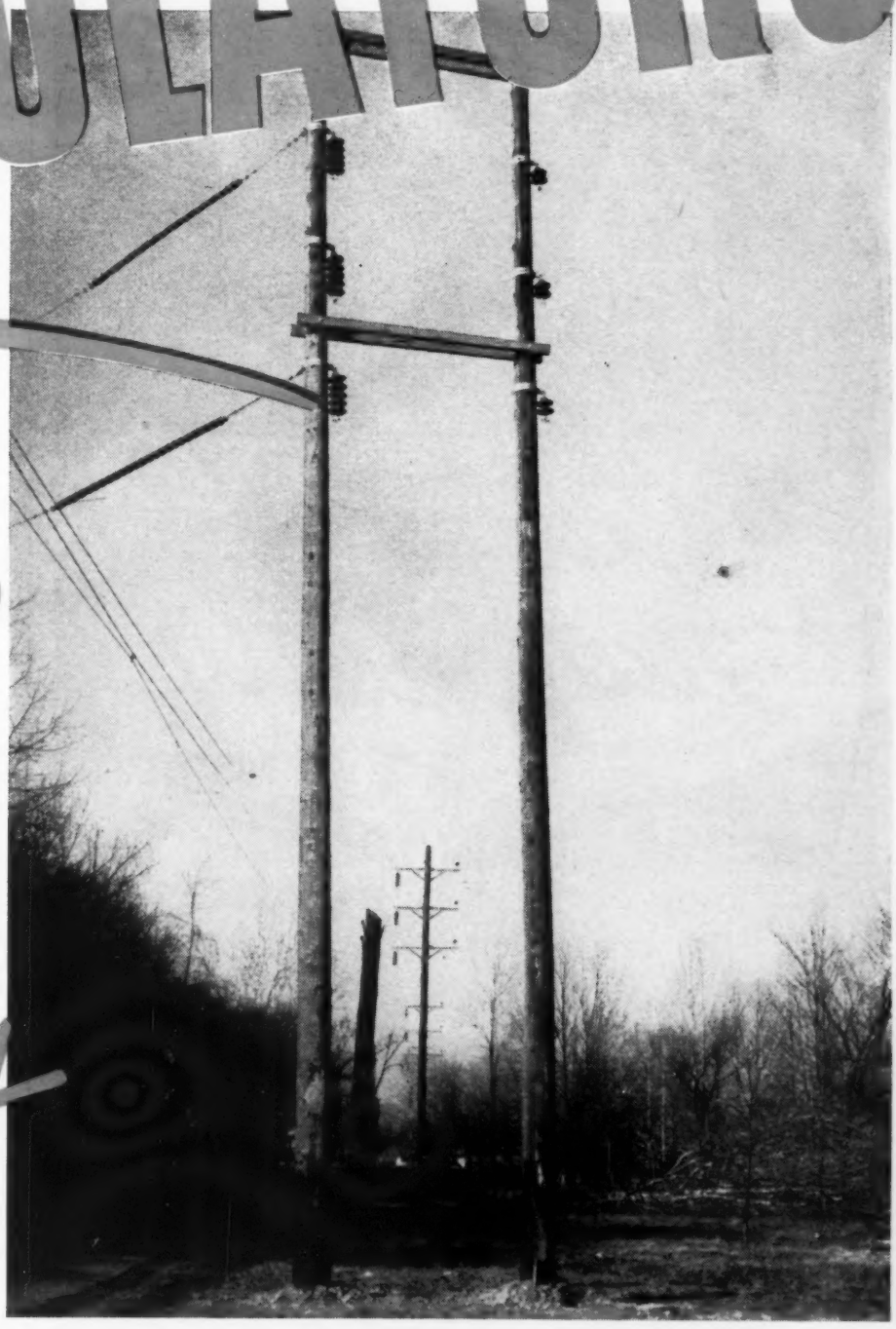
METAL-CLAD SWITCHGEAR was selected for the third section of Union Electric Power's Venice No. 2 station near St. Louis, Mo., when work was resumed on this project after an interruption of about three years during the recent war. Describing this before a recent meeting of the Electrical Equipment Committee of the Edison Electric Institute, C. C. Dodge of the Stone & Webster Engineering Corp., engineers on the project, stated that the 13.8-kv. switching equipment for the older sections of the station was installed in masonry cells, which provided a maximum of safety for oil-filled breakers and adequate isolation of compartments by fire walls. Experience with 4,000- and 5,000-amp. air circuit breakers in the first and second sections indicated that satisfactory and reliable service could be expected with an all air circuit breaker layout, and this, coupled with the elimination of oil fire hazard, led to the selection of all air breakers for section 3.

It was felt that some of the safety advantages of masonry construction could be incorporated in the metal-clad switchgear layout. The design of the switchgear, which was of Westinghouse construction throughout, provides for fire walls of masonry between separate switchgear groups, using gas-tight insulating bushings at walls and floors penetrated by connections. Complete phase-to-phase and phase-to-ground bus differential protection insures rapid isolation of faulted bus sections. It is felt that the combination of the fire wall and bus




**ISOMETRIC DRAWING of metal-clad switchgear layout in third section of Venice No. 2 station, with location of fire walls of masonry, bus locations, electrical circuit arrangements and utilization of building design held up by war conditions**

# HAS A 27-YEAR OLD INSULATORS



**--LED TO THE SAME CHOICE TODAY**

**--And, after 27 years of top performance under varied conditions, it is only logical that for this new line O-B is the CHOICE OF INSULATORS!**

Brass

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MANSFIELD, OHIO

Canadian Ohio Brass Company, Limited
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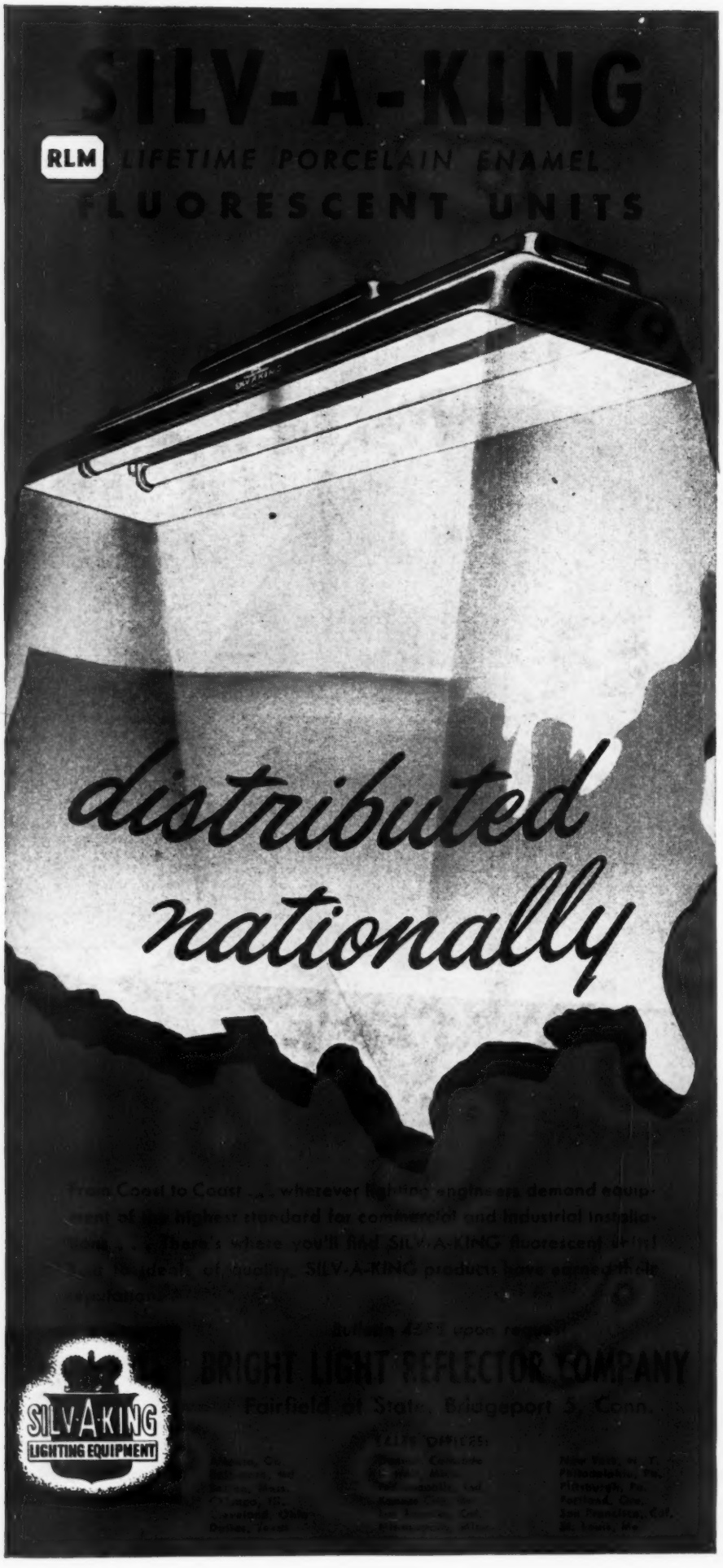
***HEADQUARTERS FOR PORCELAIN INSULATION***




differential protection will localize all sectional troubles.

Switchgear, buses and connections are designed to fit the building, which was originally laid out for masonry construction. The same number of floor levels and electrical bay grades was used as before planned. The switchgear includes the manufacturer's type 150-CA compressed air breakers varying in rating from 2,000 amp. for feeder circuits to 5,000 amp. for the synchronizing bus tie. All breakers except the 5,000-amp. units have a rated interrupting capacity of 1,500,000 kva., and buses and connections (except for the synchronizing bus) are designed to withstand an initial asymmetrical short of 130,000 amp. The breaker is completely isolated from the disconnects. The synchronizing bus tie breaker has a rated interrupting capacity of 2,500,000 kva., and the bus is designed to withstand an initial a.s.c. of 190,000 amp. Complete phase-to-phase isolation is insured at all points by metal barriers and by using Y-connected potential transformers. Resistance loading on the secondaries of these last is used to prevent inversion of the neutral. Each air breaker has tank capacity for two opening-closing cycles. A central compressed air supply, which includes four sets of compressors and main storage tanks, maintains pressure in the individual breaker tanks.

•

## Capacitors Can Cause Motors to Reverse

**HUGH VAN HORN**
Senior Engineer
Georgia Power & Light Co.
Valdosta

CAPACITORS, installed for power factor correction, may cause three-phase motors to reverse their direction of rotation. This fact was learned when one fuse blew on a 2,400-volt branch line serving a small three-phase load through an open-delta transformer bank which had one single-phase capacitor unit installed on its primary side (Fig. 1-A); Fig. 1-B shows the 2,400-volt circuit after the fuse blew.

Fig. 2-A and 2-B explain, vectorially, this phase sequence reversal. Fig. 2-A shows the vectors, involved in the phase sequence reversal, before the fuse blowing. In Fig. 2-B, after

# *Industry Approval...*

## the test of any product

*Send for factual literature on any American bodies, ladders, or Tower Lift. (Illustrated — Crew Compartment B-4).*

● The power, light, gas, and communications industries have been co-operating with us for 30-odd years. This close association has resulted in the kinds of bodies you need to maintain your high standards of service at lowest cost.

Standardization has been the key of the effort. As a result, American bodies have become industry standards. They include —line construction, light line service, general service and meter installation, utility, crew compartment, maintenance, installation, tree trimming and others.

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**OFFICES** 350 MADISON AVE., NEW YORK 17, N. Y. INSURANCE EXCHANGE BLDG., DES MOINES 9, IOWA

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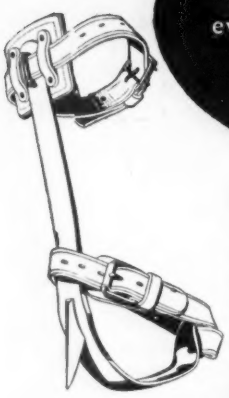
WHERE QUALITY
REALLY COUNTS!

When you're up on that pole, Mister, quality and comfort mean everything! Just ordinary equipment isn't good enough. It must be the best!



❶ That's why the famous STEPHENS CLIMBERS are in such demand by power companies, telephone companies, and individual linemen. Manufactured exclusively by Buckingham of Binghamton for nearly 50 years, *Stephens Climbers*, like all Buckingham linemen's equipment, use only the finest materials, to conform with the highest safety standards.

❷ Buckingham No. 56-R Floating *Tool Belt* is made of tan color harness leather and lined with soft chrome lace leather. No metal contacts the body. The "floating" feature insures full-open tool loops under all working conditions. An additional feature is the resilient, rubberized wool body padding, for extra comfort and ease.

❸ Here's another example of Buckingham quality — where quality really counts! Buckingham *Safety Straps* — made by workmen who recognize the responsibility that each belt carries with it.

**Immediate DELIVERY** on all Buckingham Equipment

**Buckingham**

*Walter E. Craw, President*

MANUFACTURING CO., INC.

5-7 Travis St., Binghamton, N.Y.

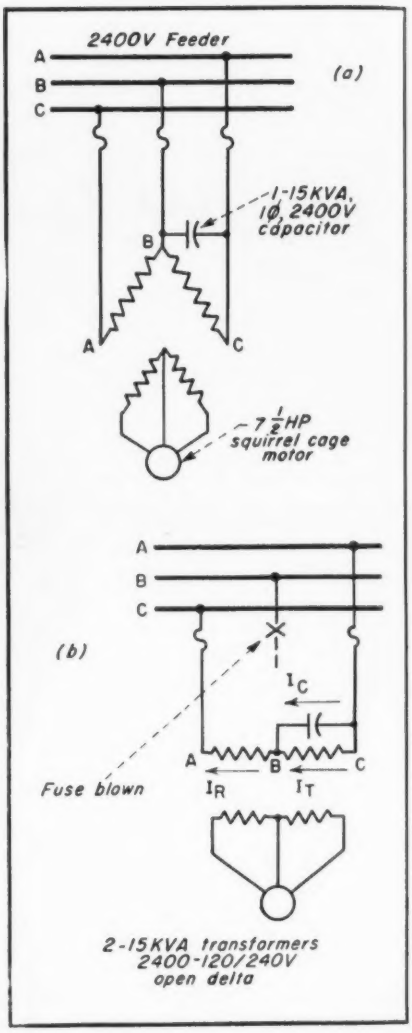




Fig. 1—Blown fuse and single-phase capacitor leads to reversal of phase sequence. (a) Before fuse blows; (b) After fuse blows

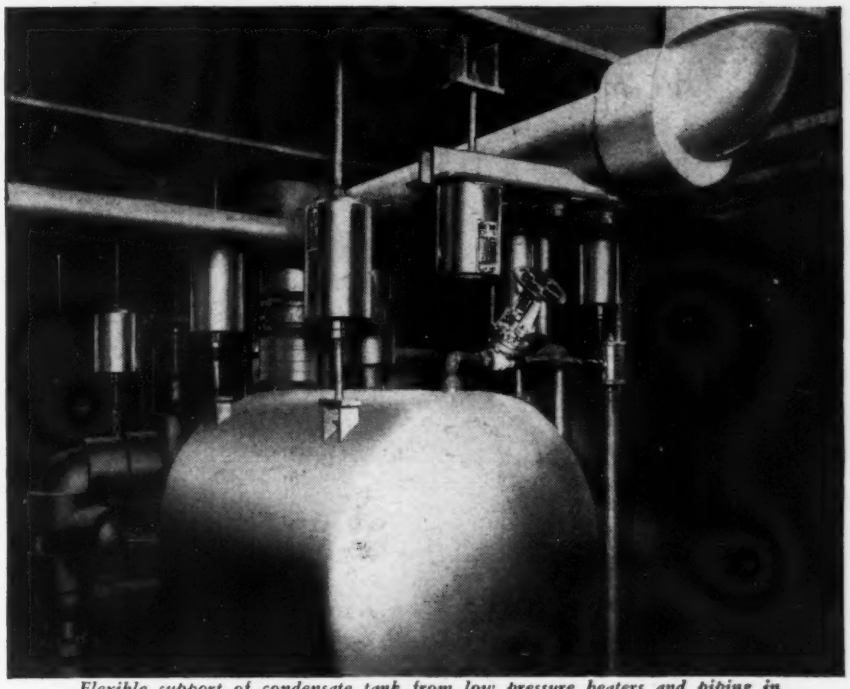
the fuse has blown, it is shown that the capacitor current and the current through transformer B-C unite to form the resultant current which flows through transformer A-B. Due to the impedance characteristics of the transformer, the voltage $E_{ab}$ leads the resultant current. In order to maintain this phase relationship, the point B, which is free to move due to the fuse blowing, takes a new position B′, thus reversing the phase sequence. Voltage $E_{ac}$ is held at 2,400 volts by the two incoming lines A and C but voltages $E_{ab'}$ and $E_{b'c}$ vary with the motor load and may be dangerously high.

In another case it was learned that phase sequence reversal may be caused by a three-phase capacitor bank on a line serving mixed three-phase and single-phase loads through a closed-delta bank when one phase of the primary supply is opened.

These experiences indicate that it

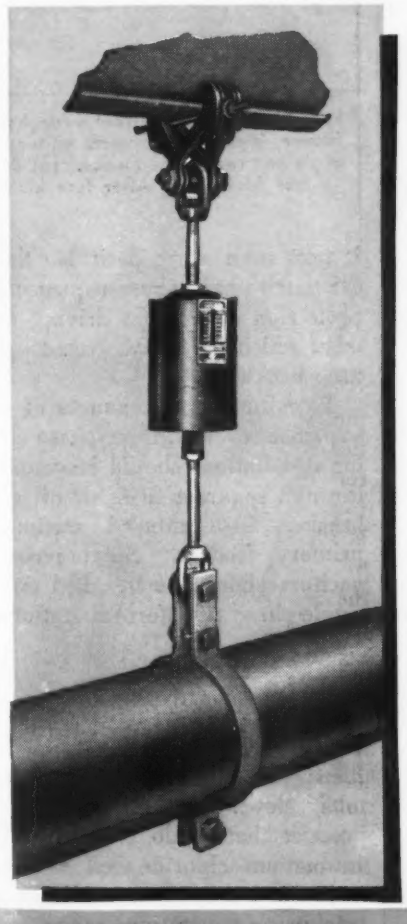
# FLEXIBLE SUPPORT OF PIPING

## made easy for you



*Flexible support of condensate tank from low pressure heaters and piping in Consolidated Edison's Hell Gate Station.*

## with GRINNELL PRE-ENGINEERED SPRING HANGERS



FLEXIBLE support of piping subject to thermal movement is now a simple matter for you – just select a stock Grinnell Pre-Engineered Spring Hanger that exactly meets the load requirements.

After computing the load it is easy to select the proper size of hanger from a simple capacity table. The 14 sizes include a load range from 84 lbs. to 4700 lbs.

### *LOOK AT THESE FEATURES . . .*

- The maximum variation in supporting force per ½" of deflection is 10½% of rated capacity – in all sizes.
- Guides prevent contact of coils with casing wall or hanger rod and assure continuous alignment and concentric loading of spring.
- Compact – minimum headroom made possible by precompression*
- Precompression* assures operation of spring within its proper working range where variation in supporting force is at a minimum.
- All-steel welded construction meets pressure piping code.
- 14 sizes available from stock – load range from 84 lbs. to 4700 lbs.
- Easy selection of proper sizes from simple capacity table.
- Installation is simplified by integral load scale and travel indicators.
- Unique swivel coupling provides adjustment and eliminates turnbuckle.

**Precompression is a patented feature*

*Write for descriptive folder on Pre-Engineered Spring Hangers Fig. 268.*

GRINNELL COMPANY, INC.
*Executive Offices: Providence 1, R. I.*

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| N. Kansas City 16, Mo. | | Seattle 1, Wash. |

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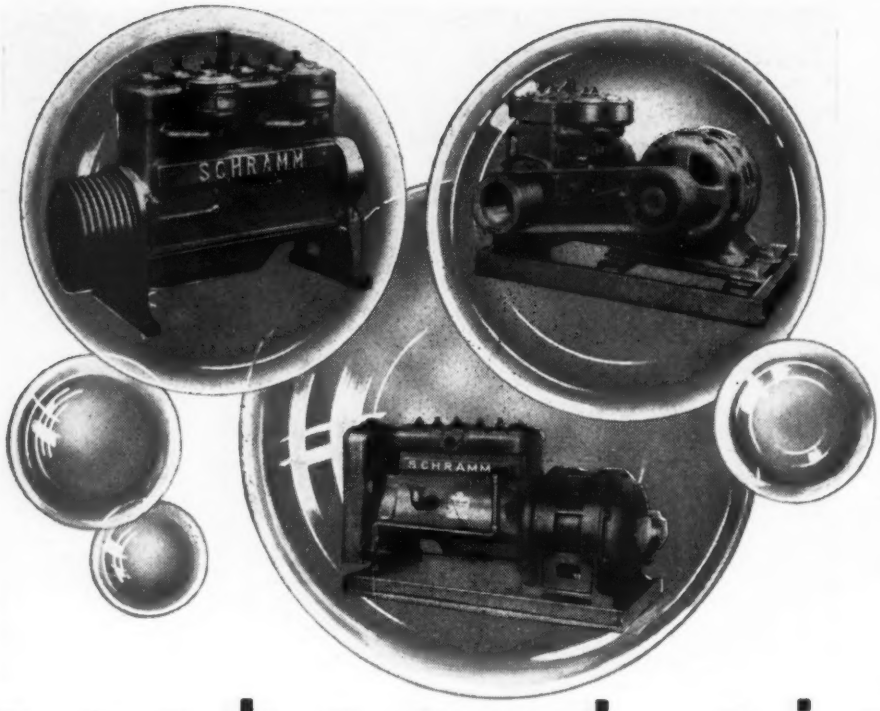
WHENEVER PIPING IS INVOLVED




# packaged air

is more than a pipe dream. SCHRAMM COMPRESSORS, for example, package air every day for industrial consumption. The selection of SCHRAMM AIR COMPRESSORS is influenced by features that include: (1) 100% water cooled; (2) forced feed lubrication; (3) mechanical intake valve; (4) compact, lightweight. Designed for heavy duty, continuous service and minimum attention. There's a SCHRAMM AIR COMPRESSOR for your every need, in sizes ranging from 2 to 600 cubic feet displacement.

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THE COMPRESSOR PEOPLE
WEST CHESTER, PENNSYLVANIA

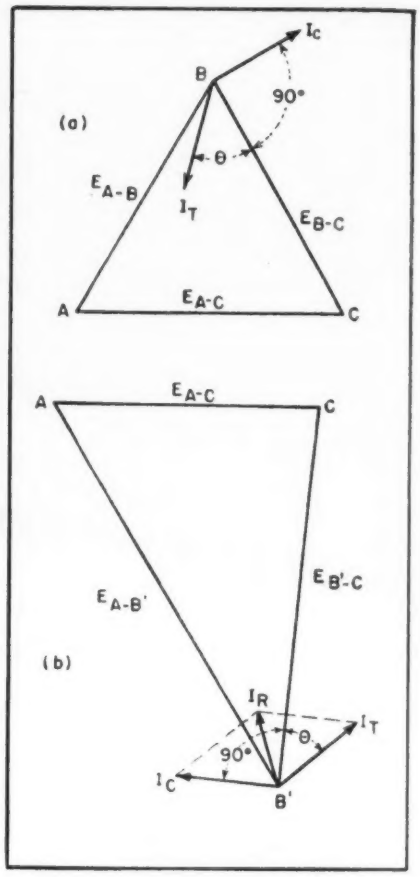



FIG. 2—Capacitive current through transformer impedance distorts voltage triangle and reverses sequence. (a) Before fuse blows; (b) After fuse blows

is now even more desirable than in the past to have phase-sequence relay protection on motors driving equipment which may be damaged by running backward.

To minimize the chances of phase sequence reversal, three-phase capacitor installations should be connected, through separate fuses or oil circuit breakers, to unfused sections of primary feeders. Single-phase capacitors should be installed only on single-phase transformer stations.

•

## Arctic Dry Cells

DRY CELLS that perform satisfactorily down to —22 F. are a war product that outdo the conventional ammonium chloride cell which becomes inoperative at —4 F. This extension of operating range is obtained by resort to calcium chloride in conjunction with zinc chloride. Output ability is enhanced by addition of ammonium chloride. Details have been given in a recent National Bureau of Standards paper by Vinal, Otto and Morehouse.

# UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

I JUST KEPT LOOKING UNTIL I FOUND IT!

Laytex (Type RU) branch circuit wire is *different*—and *better.*

It is smaller in diameter than any other rubber insulated building wire. It's lighter in weight—easier to handle.

Furthermore—it is insulated with 90 per cent unmilled, grainless natural rubber, and has perfectly centered conductors.

And last—but not least—it leads the field in physical and electrical properties.

*RU wiring with RU?*

**Small diameter • Light weight • Natural rubber insulation Perfectly centered conductors • High tensile strength • High dielectric strength • Flame retardant, moisture resistant cover**

**UNITED STATES RUBBER COMPANY**
**1230 Avenue of the Americas • Rockefeller Center • New York 20, N.Y.**

U.S. LAYTEX

U.S. Laytex

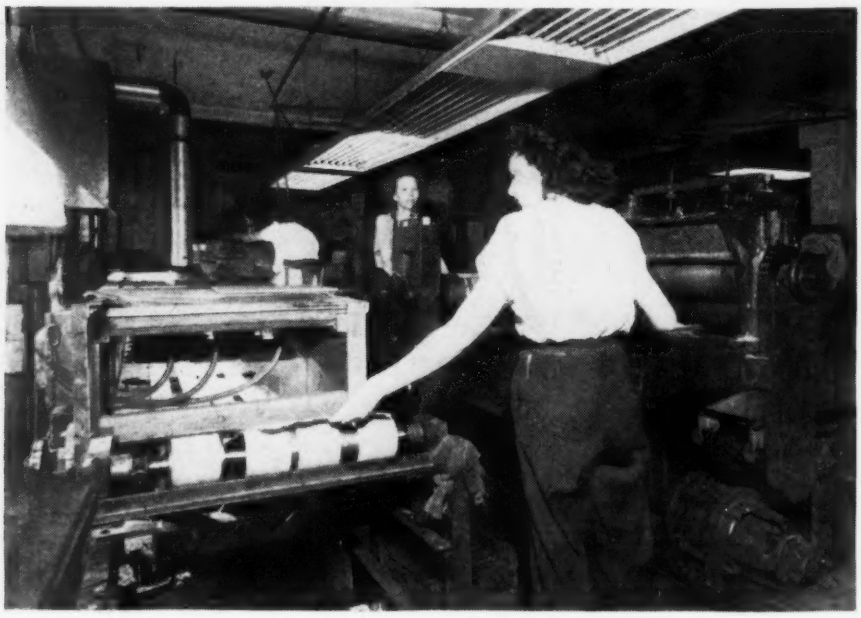
Reg. U. S. Trade Mark

**ELECTRICAL WIRES AND CABLES**

# LOAD BUILDING

## Infrared Halves Drying Time in Banknote Printing

CONTROLLING the moisture content of stock and dehydrating and drying of the final impressioned sheets are principal problems in the printing of currency, banknotes and stock certificates. At the Jeffires Banknote Co. of Los Angeles, the drying operation has been greatly speeded up and more satisfactorily done with the infrared unit shown. It consists of a Fostoria, 54-reflector infrared drying zone with 13.50 kw. in 250-watt lamps. Sheets pass through an 18-ft. tunnel at a conveyor speed of 36 ft. per min. The conveyor belt rides over a sheet metal bed the entire length of the tunnel. The metal bed radiates the heat uniformly and adds to the efficiency of the drying and dehydrating operations.



INFRARED banknote drying oven—Impressioned currency, banknotes and stock certificates are completely dried in 30 sec., passing through tunnel under 13.5 kw. of infrared

The tunnel is arranged with the reflectors forming a flat ceiling with reflector channels running vertical to the conveyor. Reflectors are 12 in. from conveyor, and sides of the tunnel are shielded to prevent drafts from crossing the material. As the sheets dry, the moist air is exhausted from the tunnel. All moisture is entirely removed from every sheet in 30 sec., the time required for a sheet to travel the length of the tunnel. Approximately 12 out of every 24 hr. are saved in dehydrating and drying, over the old method where sheets had to be hung on lines with clothes pins.

• • •

## Electric Home Planning with Models

**HARRY R. FIENE,** Director Field Sales, Omaha Public Power District, Omaha, Neb.

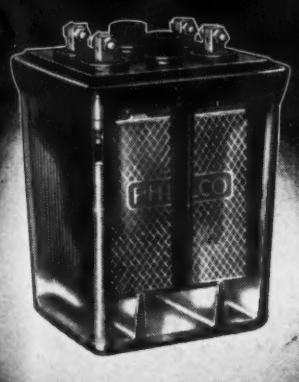
MINIATURES to show how a customer's new kitchen will look have been found the most effective sales tool we have ever used. This method, with photographs to supplement drawings, has grown from several years experience in preparing kitchen plans for home owners of Omaha. Requests for the service have been increasing, and 280 layouts were made in the past year.

Our field men take the measurements in homes which are to be remodeled or they consult the building plans for new construction. After the floor plan is drawn, the miniatures are set up on a table, as in the accompanying illustration, and photo-

MINIATURE KITCHEN is set up to be photographed for a customer plan folder

# Full Capacity a **Must**

*Install a modern Philco* ***Floté*** *Battery with assurance that high capacity will be maintained. Because a Philco has the most important stationary battery improvement in many years . . .* ***the Floté element that eliminates low cells*** *in full float service. To cost-minded engineers, this means that a Philco stays fully charged at lower maintenance cost . . . that a Philco delivers more years of efficient, dependable service per dollar invested. Write for specification data.*




# PHILCO

## STORAGE BATTERIES

PHILCO CORPORATION • STORAGE BATTERY DIVISION • TRENTON 7, NEW JERSEY

THE MASTER OF FLAME
ANSUL
REG. U.S. PAT. OFF.
FIRE EXTINGUISHING EQUIPMENT
duGas

DRY CHEMICAL • FIRE EXTINGUISHERS

New...

*Faster Put-out by Inexperienced Operators*

The difference between a small fire and a major disaster may be only a matter of seconds... WHEN THE FIRE STARTS.

An outstanding feature of the new Ansul-Dugas Extinguisher is its simple and quick operation. The new nozzle design makes expert extinguishing possible even by inexperienced persons.

HERE ARE OTHER IMPORTANT FEATURES

- 53% more Fire-Stopping Power.
- Highest Rating for SPEED and EFFECTIVENESS as determined by impartial authority.*
- Quicker, easier, on-the-spot recharge after use.
- Greater fire-fighting effectiveness pound for pound, dollar for dollar.
- Larger range stream and greater shielding of heat from operator.
- Increased fire-fighting capacity without increased weight.
- Engineered to resist corrosion.

STOP FIRE FASTER!

with Ansul-Dugas Dry Chemical Extinguisher

*Write for charts based on authoritative data of comparative ratings as determined by a national approval agency.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN

graphed by a view camera for display.

Wiring and lighting layouts are made for new homes, in addition to the complete kitchen plan. Three field men, in addition to the director, work with building contractors, architects, lending agencies and individuals. Two kitchen designers and a lighting and wiring specialist comprise the planning staff.

•

## Tell Dealers How to Install Water Heaters

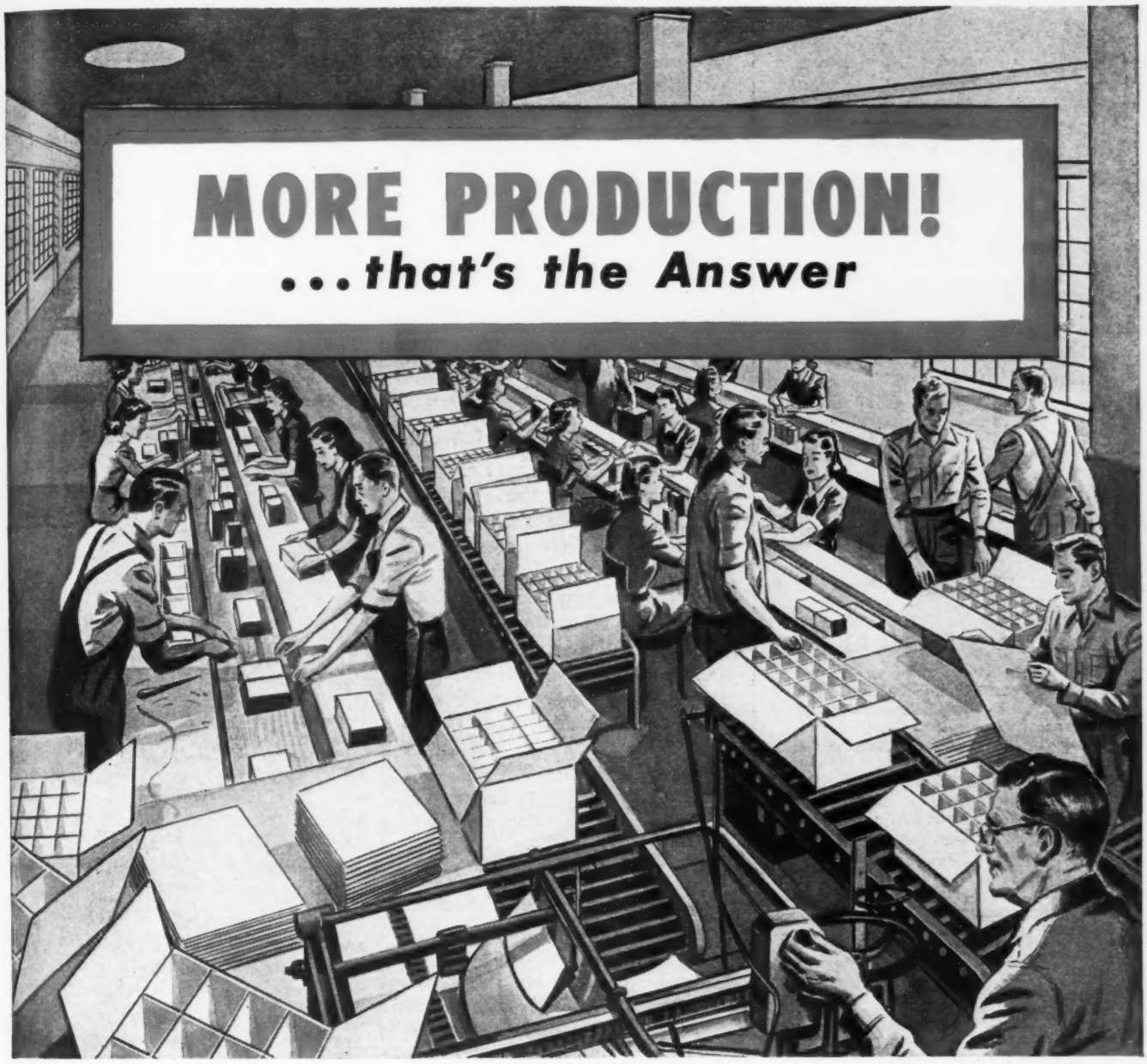
ROBERT LATIMER
St. Louis, Mo.

APPROXIMATELY 150 leading electrical dealers in the St. Louis area are aggressively pushing electric automatic water heaters, as the result of a cooperative plan worked up by Union Electric Co. of Missouri.

On the theory that the electrical dealer is most logically positioned to sell and install water-heating equipment, the residential sales department of the company went to electrical dealer associations, etc., to determine sales possibilities, and to iron out any "kinks" which stood in the way. Through research among dealers, it was discovered that heretofore electric water heaters have not been a competitive item due to high initial, and relatively high operating, costs. Also, it was found, dealers are almost universally accustomed to 30-gal. heaters, and would require plenty of education to install the 40- to 85-gal. units proposed. Lastly, it was discovered that most dealers were unwilling to undertake the electrical installation, thermostatic controls, etc., involved, both because of the expense and fear that the necessary wiring might not pass inspection.

Each of these problems has been "solved in advance" by Union Electric. First, the objection of high operating cost was eliminated by the institution of a new off-peak water heating rate of 9½ mills per kw.-hr. in rural districts, 8½ mills in the city. Heretofore, the lowest residential charge had been 1½ cents.

Next, Union Electric set up a plan whereby the $15 to $25 cost of making the electrical installation is subsidized through plumbing supply houses, jobbers, etc., to remove this extra charge from the dealer's scope. Electrical dealers may actually sell the




Men working together, for production, can give America what it needs: more and finer products ...greater *values* ... better standards of living... for all! Slow-downs or forced idleness deprive everyone of the gains industry can offer only through more production.

Only through cooperation for production can America benefit by the great technological advances of recent years. Modern MOSINEE papers, for instance, custom-made to meet specific requirements, are helping to improve products, slash costs, raise standards of living.

MOSINEE paper technicians are equipped to create paper with scientifically controlled chemical and physical characteristics to improve many products and processes. Call MOSINEE!

MOSINEE PAPER MILLS CO. MOSINEE, WISCONSIN

# MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

*Essential Paper Makers*

*Please address your letter to Attention Dept. B"*

CABLE INSTALLATION CREWS PREFER COPE EQUIPMENT

STRONG COMPACT ATTRACTIVE **WARNING EQUIPMENT**

AVAILABLE IMMEDIATELY

**SAFETY GUARD RAIL**

Entirely constructed of steel pipe welded for extra strength. The wing bow brace, a "Cope" exclusive, locks the frame in the open position and permits the use of chains on the open side instead of the usual arm hook arrangement. The chains may also be used for locking the folded guard rail to standing equipment or poles while not in use. Warning signs or advertising messages may be attached as illustrated.

Quotations on this or your own design on request.

**SAFETY WARNING SIGNS**

"Cope" Warning Signs are extremely rugged with welded steel frame and steel panel. The legs lock in position and fold as compactly as a card table, requiring a minimum of space. When placed squarely in position they will not blow over or collapse.

The sign illustrated stands 30" high and 18¾" wide with an 18" square panel painted with 5" letters. Quotations on this or specially painted panels on request.

Write for complete catalog and prices.

T.J. Cope INC.
6120 Vine Street,
Philadelphia 39, Pa.

TOOLS AND EQUIPMENT FOR THE INSTALLATION AND MAINTENANCE OF CABLE FOR OVER FIFTY YEARS

water heater directly from their own retail showrooms, or through the plumbing supply house, with Union Electric underwriting the total cost of installation. This expense, the company feels, is well worth while as a means of leveling off peaks.

To cope with the third problem, that of proper installation, Union Electric has instituted training classes and compiled a precise, comprehensive sales manual. Both are designed to teach electrical dealers to make larger installations, that electrical water heaters will maintain water at 150 deg. temperature, capable of lasting much longer through the admixture of much cold water, etc. Promotion is now in the training stage, and will be backed up later with large scale advertising programs benefiting individual dealers. In each case, the company will emphasize not fast recovery, but hot water at the faucet. Plumbers will be urged to sell sizes from 40 to 85 gal., or twin units of two 60-gal. heaters where large families are involved.

***Sales Manual***

The sales manual is most comprehensive. Designed specifically for dealers, it covers reasons why the customer should buy, the all-important question of what size heater, things a dealer should know about the cost of service, and most important, a ten-page section giving specifications for plumbing and wiring, workmanship and material, installation, piping, plumbing diagrams, wiring, re-use of existing wiring, and exact, precise diagrams of installations for four different sizes of typical families. Over 44 pages, the three-color manual is designed to help the dealer to sell his prospect on electric heat as the most modern way of providing hot water for household uses. The section on installation, which was written against the background of actual dealer's questions, covers estimating, the ultimate figuring, the providing of adequate amounts of hot water for specifically sized families, how to pass engineering and electrical inspections, etc. "We wanted every dealer to be able to make the complete installation right from the manual," said Shel Bascom of the company's residential sales department, "and so far, the idea has worked out beautifully."

Requests from electrical dealers for copies of the manual have almost exhausted the initial supply, according to Union Electric—and many installations have already been sold. The program will be left in the manual stage until a sufficient supply of heaters is on hand in the supply houses, it was indicated, after which training classes will be held in the company auditorium for electrical dealers who wish to see demonstrations of installation technique.

•

## Survey Shows Advantages of Electric Industrial Trucks

ELECTRIC BATTERY powered trucks for use inside factory and warehouse buildings are widely accepted because of their freedom from gasoline exhaust fumes, greater ease of handling, and lower out-of-service time for repairs. A recent survey among large users of industrial trucks in an area served by a midwestern utility also shows definite advantages for electric operation on a cost basis.

This company found that 1,453 electric trucks were in use, with battery charging from its service. With an average of 20 kw.-hr. per day per truck, this load represents about seven million kw.-hr. annually.

Experience of several plants with large fleets of industrial trucks was reported in detail.

One plant with 72 electric trucks averaged 2½ trucks per day in the repair shop. Another plant, with gasoline trucks, had one reserve truck for each five in use. Battery life in one large group averaged six years, and labor for battery maintenance has been five minutes per day, with parts costing five to ten cents per battery per month.

Cost records in another plant compared the operations of gasoline, gas-electric and battery operated trucks under similar conditions. Costs per hour of operation, for operation and maintenance, were found to be as follows:

| | Gas | Gas-Elec. | Battery |
|---|---|---|---|
| Repair labor | .0627 | .0364 | .0106 |
| Repair material | .1583 | .0900 | .0429 |
| Fuel | .0885 | .0742 | .0300 |
| Total per hour | .3095 | .2006 | .0835 |

Average lost time for repairs and maintenance in this plant was 10½ percent for gasoline trucks, 6.1 percent for gas-electric and 1¾ percent for battery operated trucks.

# The New Guth HINGED GLASS ARISTOLITES

## KEEP MAINTENANCE COSTS DOWN BECAUSE THEY KEEP MAINTENANCE MEN DOWN!

## *Yes, Right Down on the Floor!*

Fluorescent Luminaires must be cleaned regularly because accumulated dirt can cut light output as much as 50%. With ordinary Fixtures, the cleaning operation is slow, awkward, time-consuming. Maintenance Men drag ladders all over the premises, disturb workers, waste time and energy climbing up and down.

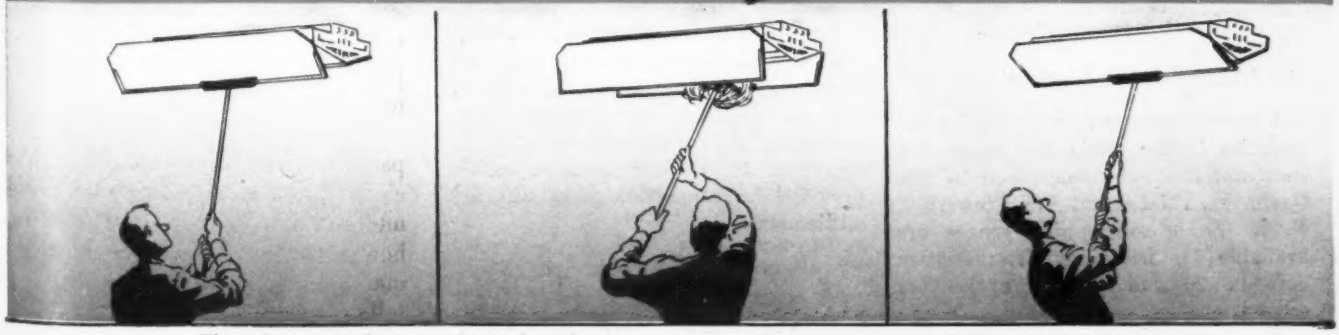
With the new GUTH Hinged Glass ARISTOLITE*, the entire operation can be performed *from the floor!* A simple gripper on the end of a pole swings the glass panels free, a duster on the opposite end of the same pole cleans the Fixture, and the panels are then quickly replaced and securely seated.

The new GUTH Hinged Glass Aristolite, like its famed predecessor, the standard Aristolite, provides fine diffused Fluorescent illumination which makes for safe, comfortable, easy *seeing.* In addition the Hinged Aristolite provides safe, comfortable, easy *maintenance,* too!

***It's the Fixture that's serviced in a minute . . . serviced RIGHT . . . right from the floor!***

*Trade Mark Registered—Patents Pending

## MINUTE-MAINTENANCE WITH THE NEW Guth HINGED GLASS ARISTOLITES



OUR 45th ANNIVERSARY YEAR

The glass panels are released and swing open on their hinges. A quick dusting restores lighting efficiency to the Fixture. The glass panels lift back and are seated in small metal flanges. For relamping, one trip up the ladder replaces the customary three or four. Less time . . . more safety!

***Write today for full information that tells how the New Hinged Glass Aristolite can reduce maintenance time and costs.***

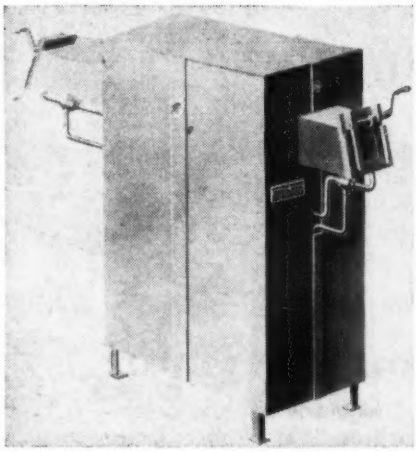
**THE EDWIN F. GUTH CO.** • 2615 WASHINGTON AVE • ST. LOUIS 3, MO.

Guth *Leaders in* LIGHTING SINCE 1902

# NEW EQUIPMENT

## New Electric Furnace Rated at 20 Kw.

A NEW BOX FURNACE, designed for laboratory use where automatically controlled temperatures up to 3,100 deg. F. are desired, has been announced by the industrial heating division, General Electric Co., Schenectady, N. Y. The furnace is suitable for such applications as the melting and bright annealing of metals, sintering of powdered materials, reduction of metallic oxides, ceramic firing and copper and silver alloy brazing of metals. Since the units must be protected against oxidation, the furnace is limited to operations which can be performed in a protective atmosphere, the manufacturer states.



The heating units are rated at 20 kw., 65 volts single phase at 3,100 deg. F. They are molybdenum rods formed into sinuous loops and supported inside the heating chamber. This chamber is 4 x 4½ x 25 in. and is lined with refractory brick backed by heat insulation.

A cooling chamber permits materials to be cooled in a protective atmosphere, preventing oxidation of the charge. This water-jacketed chamber is separated from the heating chamber by a manually operated sliding door.

The doors of the heating and cooling chambers are equipped with manually operated flame control curtains.

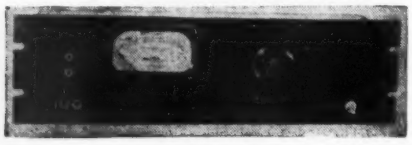
Automatic temperature control is provided by a standard-pipe temperature control instrument mounted on the panel. This instrument may be either strip chart, round chart, or indicating type, and operates from a radiation thermocouple. A Reactrol unit is used to vary the power input in accordance with temperature requirements. This unit is an automatically controlled rectifier which varies a small direct current through the saturable core reactor, causing it, in turn, to vary the alternating current voltage applied to furnace heating element.

•

## Frequency Meter Covers 20 to 100,000 Range

A NEW INSTRUMENT for measuring frequencies in the audio and supersonic spectrum has been announced by the Davin Co., 191 Central Ave., Newark 4, N. J. Seven overlapping ranges are available for frequency determination between 20 and 100,000 cycles per second.

The instrument is reported to have a high input impedance and to have an accuracy on all ranges of 2 percent of the top frequency of the range in use. Indication is reported as substantially independent of variation in input voltage between 0.5 and 150 volts rms. The instrument panel measures 5¼ x 19 in. and is designed for standard rack mounting. Where a continuous graphic frequency record is desired, a jack is provided for connection to an external milliameter.



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## Capacitor Analyzer Covers 10-Mmf. to 800-Mf. Range

A NEW SMALL, lightweight capacitor analyzer with a range from 10 mmf. to 800 mf. has been announced by Solar Mfg. Corp., 285 Madison Ave., New York 17, N. Y. The unit, designated as Model CBB, is reported as an improvement over Model CB with improved components for use in high humidity areas and with an extended capacitance range. A "Magic-Eye" tube is used for bridge balance indication, while simplified neon lamp test circuits are used for visual checks of the insulation resistance of electrostatic capacitors and the leakage current of electrolytic capacitors. The instrument may also be used as a line frequency resistance bridge covering a range of 50 ohms to 2 megohms.

•

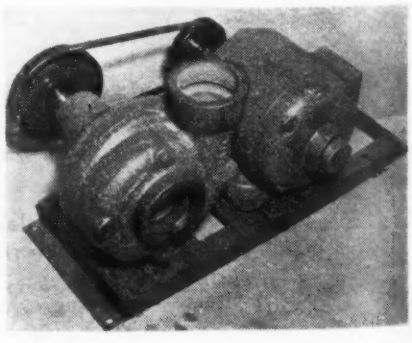
## Toaster Heating Element Fits All Standard Frames

A TOASTER heating element which is adaptable to all standard frame toasters now in use and which is made possible by a new type adjustable clip has been announced by H. W. Tuttle & Co., Adrian, Mich. It is built of die-cut mica, wound with flat ribbon Nickel-Chrome alloy resistance wire and draws 475 watts.

•

## Centrifugal, Pedestal Type Pumps Made in Three Sizes

A NEW LINE of "Pedrifugal" pumps with capacities from 10 to 500 gpm. has been developed by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The new pumps are of the cast iron, bronze-fitted, pedestal type and are available in three principal sizes—1 in. by 1 in., 2 in. by 2 in., and 3 in. by 3 in. They



are designed to operate at heads up to 100 ft., and power requirements are from ¼ to 15 hp. The units are of the centrifugal type and are splatter-finished with gray enamel.

They are designed for use with V-belt

# HUBBARD AUTOGAP FUSE CUTOUT

NO. 2315

HUBBARD AUTOGAP FUSE CUTOUT is a combination of No. 2302, 9 KV Autogap Lightning Arrester with a new, improved 7-1/2 KV open type fuse cutout. The assembly is Stock No. 2315.

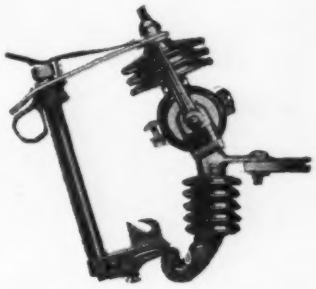
VOLTAGE, phase to ground is recommended to be limited to 7500 Volts.

FUSE rating is 50 Amperes. Fuse links are not furnished. Any standard can be used.

INTERRUPTING CAPACITY of the Hubbard Autogap Fuse Cutout is 1200 Amperes.

MOUNTING Brackets are available. No. 2323 for Crossarm and No. 2325 for pole. Specify type of mounting when ordering.

WEIGHT of the assembly is 18 Pounds each, packed for shipment.



**CLOSED POSITION:** The flat, phosphor bronze spring at the top is in tension, ready to kick out the mechanism instantly when the blowing of the fuse releases the tension.

**OPERATING:** This view shows the action during transition from "closed" to "open" positions. The fuse has blown and the toggle mechanism is forced open by the top contact spring. The gap caused by the blown fuse is instantly lengthened to at least 3-inches by the leverage of the toggle mechanism, causing the arc to be extinguished within the fibre fuse tube rather than at the top contacts, where burning might occur.

**OPEN POSITION:** Top contact spring is relaxed, having exerted its pressure toward opening the mechanism. Tube drops to hanging, open position which places the notch for "hot-stick" removal of fuse tube in an accessible spot.

## HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.

# BERMICO*
## FIBRE CONDUIT

## FOR SUREST CABLE PROTECTION - - - SPECIFY BERMICO CONDUIT

1 **LIGHT.** Easily handled on the job; one man can carry several 8-foot lengths at once—lay more per working hour.

2 **TIGHT.** All joints are precision milled for tight, speedy, installations.

3 **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.

4 **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

5 **WATER PROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.

6 **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

7 **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

*distributed by*
**WESTINGHOUSE ELECTRIC SUPPLY COMPANY**
Offices in all leading cities

* Reg. Trade Mark

BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY


drives and capacities may be regulated by size of sheaves and power supplied. The units are reported to operate in any position and to be applicable to large Diesels, heat exchangers, cooling towers, air conditioners, etc.

Construction features reported are single fit between pedestal and casting, open impeller keyed to the shaft and fitted with an impeller lock nut, a mechanical seal, and two bearings for either direct or belt drive. The units are available with or without motors installed on the pedestal.

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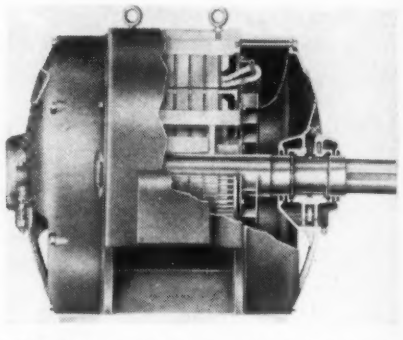
### Squirrel Cage Motor Design Facilitates Cleaning

A NEW "heavy-duty" squirrel-cage induction motor, of drip- and splash-proof construction, in sizes from 100 to



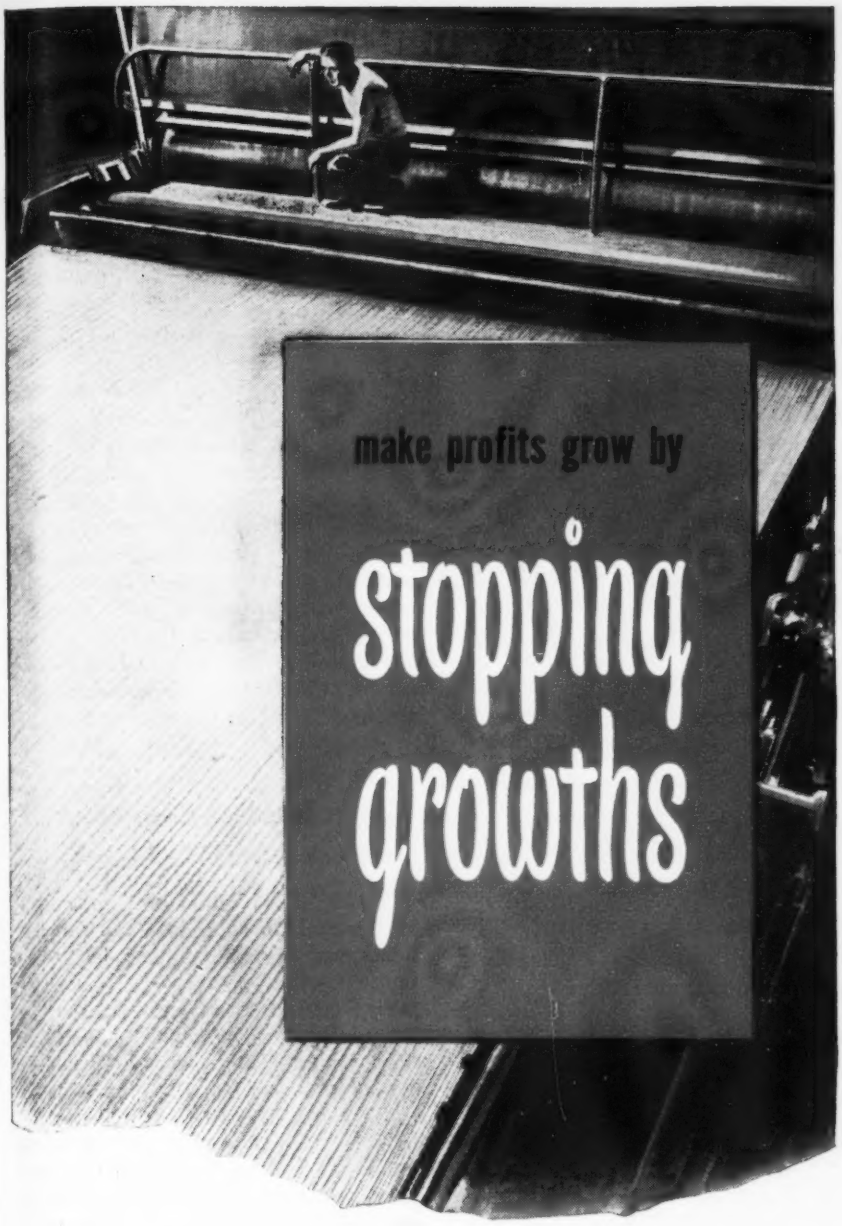
1,000 hp., and in speeds of 1,800 rpm. and lower, has been announced by Electric Machinery Mfg. Co., Minneapolis 13, Minn.

The manufacturer reports that inspection and blowing out are simplified on larger ratings because of the access plates. Sealed bearings can be cleaned and refilled without motor disassembly, it is stated. Double end ventilation is provided by a blower on each end of the rotor. Starting characteristics are NEMA Class B (normal torque, low starting current), for across-the-line starting.

•

### Mechanism Reverses Polarity In Plating Operations

A MECHANISM to reverse the polarity and to control a selected time cycle between the positive and negative plating times has been announced by The George L. Nankervis Co., 5442 Second Blvd., Detroit 2, Mich. It is identified as the Electro-Reversal Control Unit and consists of a moisture proof cabinet, in which are mounted various instruments such as timer controls, relays, discharge resistors, pilot lights, etc., to control the output polarity of electroplating motor generator sets. While these units have been used for




## DOWICIDES curb losses of paper

In paper manufacturing—and in other industries where micro-organisms damage materials and decrease output—Dowicides turn losses into profits.

In paper mills, slime flourishes. And slime damage is expensive. Slime causes machine "breaks," defective paper due to spots and holes, and excessive wash-up time.

Conditions fostering slime growth vary. So do organisms causing slime—algae, fungi and bacteria. Control calls for careful analysis of slime types and application of proper killing agents.

Because of their broad effectiveness, Dowicides are widely used in slime control. They cut losses, too, by prolonging wet felt life, preserving adhesives and preventing mildew on lap stock. And they make paper, boxboard and fiber board mold-resistant.

In paint, textiles, lumber, leather—wherever mold, termites or bacteria attack—ask Dow to select a Dowicide for your specific use.

**THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN**

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Ontario

## CHEMICAL COMMENTS

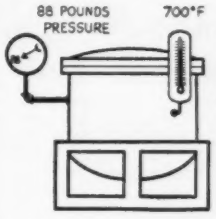
### An Effective Thickener for Improved Dye Printing

Methocel, Dow cellulose derivative, has demonstrated unusual possibilities as a dispersing, thickening, and binding agent. One of its important applications is in textile printing. As a thickener for fast color salts and diazotized bases for printing on naphthol prepared grounds, it yields prints of exceptional brightness, smoothness, and sharpness of mark with greater penetration and efficiency of dyestuff. Methocel can be used in dyes either for machine or screen printing.

### Coating Fabrics for Chemical Resistance

Saran F-122 Latex, a new Dow material for the textile industry, is used as a coating, sizing, impregnating and laminating agent in the treatment of fabrics. Coated with Saran Latex, fabrics are particularly well suited for industrial use where chemical resistance and durability are important. They can be made resistant to water, oils, greases, gasoline, acids and alkalies in the making of conveyor belting, tarpaulins and other products. Yarn and thread can also be sized with Saran Latex, making them waterproof and resistant to picking and linting.

### Flexible Heat for Paint Processing




Flexible heating systems are a necessity to many paint and varnish firms, where high-temperature processing requirements vary widely. In one Midwest varnish plant, where processing temperature requirements vary from simple heating to complex sequences of heating and cooling, Dowtherm, the high-temperature, low-pressure heat transfer medium, has been installed. With this indirect heating system temperatures can be adjusted easily for every specific job. The company uses a 3,000,000 btu/hr. Dowtherm vaporizer for heating and an independent liquid-phase Dowtherm cycle for cooling. Simple controls permit the two cycles to be coordinated for a variety of temperature combinations.

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

# Anhydroprene HAS NO BRAIDS TO ROT!

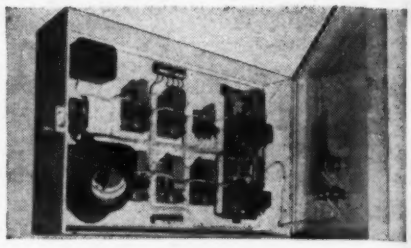
ANHYDROPRENE wires and cables are made with a thin wall of neoprene instead of a fibrous braid. There is no braid to rot or to "freeze" to the wall of a duct. The thin neoprene jacket resists oils and solvents as well as acids, alkalies and corrosive chemicals.

Anhydroprene wires can be installed overhead in messenger rings. They can be racked on the wall or they can be installed in conduits or raceways. Underground they can be used in ducts.

Simplex Data Sheet #115 has complete information on this type of wire. Write for it today.

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

a relatively short length of time in conjunction with a cyanide copper plating solution, the manufacturer reports following results:

(1) Smooth deposits made possibly by reason that treeing, which usually occurs at high current density points, is offset by the reversal phase of the cycle which levels off nodules thus formed; (2) Increased allowable cathode current density; (3) Improved plate thickness in recess or low current density areas; (4) Pore free deposits are obtained because of the alternating plating and deplating cycle effects; (5) Brighter deposits are also obtained.

•

## New Solderless Connector Usable on 46 Combinations

A NEW "4-in-1" Bakelite wire connector for making solderless and tapeless joints has been announced by Holub Industries, Inc., Sycamore, Ill. It is reported as approved by Underwriters for joining 46 different wire combinations ranging from two No. 18 to four No. 14 with one No. 18, or two No. 12 with one No. 16, solid or stranded wires. It is designed for making fixture joints, roughing-in joints, sign wiring, and joints in electrical equipment and machinery. It is a one-piece device, made of Bakelite and has a coiled spring insert which makes the mechanical and electrical connection.

•

## Self-Locking Device Developed for Safety Belts

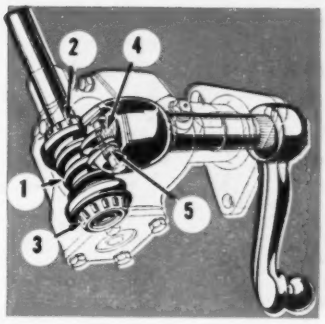
A SELF-LOCKING DEVICE that may be adapted to hooks used in the electrical industry has been developed by W. H.

REGISTRATIONS *SHOW* IT — OPERATORS *KNOW* IT!

# "FORD TRUCKS LAST LONGER!"

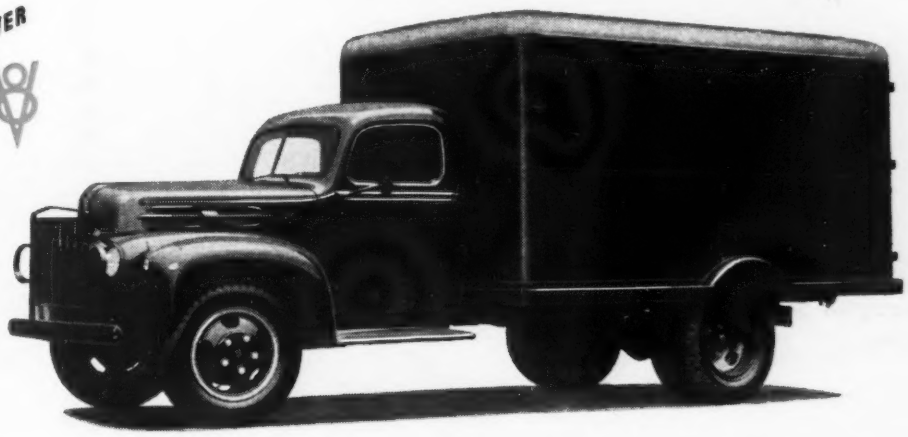
## ONE big reason— FORD STEERING STANDS UP!

Ford worm-and-roller steering gear reduces *rubbing* friction to a minimum. *Rolling contact* is employed to reduce friction at five vital points. This spares muscle and saves wear. The worm gear (1) is straddle-mounted on two large, opposed, tapered roller bearings (2 and 3). The worm acts upon an easy-turning roller instead of a common sliding cam or split-nut, and this roller is mounted on two needle-type roller bearings (4 and 5). Bearings of both the worm and the sector shafts may be adjusted, thus promoting long life and proper action with less replacing of parts.




Ford

THE 6 YOUR PICK OF POWER THE V-8



*The 158" wheelbase 1½-ton Ford heavy duty chassis and Ford cab, with Van body built by Truck & Trailer Industries, New York, N. Y.*

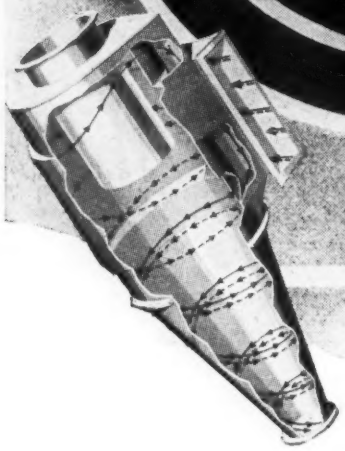
ONLY FORD GIVES YOU ALL THESE LONG-LIFE TRUCK FEATURES: Your choice of two great engines, the V-8 or the Six—semi-centrifugal clutch that needs no maintenance lubrication—rear axle design that takes all weight-load off the shafts (¾-floating in half ton units, full-floating in all others)—heavy channel section frames, *doubled* between springs in heavy duty models—big, easy-action brakes, with heavy, cast drum surfaces, non-warping and score-resistant—extra-thick sheet metal in cabs, cowls, skirts and fenders—all told, more than fifty such examples of Ford endurance-engineering.

That's why FORD TRUCKS LAST LONGER . . . why, as the national truck count for 1946 just released shows, *more than half of all Ford Trucks in use are at least 9 years old* . . . why there are more Ford Trucks in service now than ever before in history. More than 100 body-chassis combinations to choose from. Ask your Ford Dealer.

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE

high efficiency

DUST COLLECTION



Only Buell Dust Recovery equipment affords these six extra-efficiency features: 1—The "Shave-Off"; 2—Large Diameters; 3—Extra-Sturdy Construction; 4—Correct Hopper Design; 5—Split-Duct Manifolding; 6—Inner Welds Ground Smooth.

Write for Buell's book—"The van Tongeren System of Industrial Dust Recovery".

BUELL ENGINEERING CO., INC.
Suite 5001—70 Pine Street, New York 5, New York

buell

van Tongeren DUST RECOVERY SYSTEMS
DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

Foster, 4622 Kingswell Ave., Los Angeles, Calif. The self-locking hook has a fulcrumed latch member (or finger) that closes the opening into the hook. It is retained in this closed position so that it can not accidentally swing inward and thereby open the hook, the developer reports.

For swinging the latching finger into open position, a manually operated spring-held member is manipulated. A portion of this manually operated member engages a part of the latching finger at some distance from its fulcrum so as to maintain the latching finger in position to close and lock the hook, the developer has stated. The device was designed for use on safety belts, cable line, etc.

•

## Time, Thermostatic Control On New Home Pasteurizer

A NEW automatically controlled home pasteurizer has been developed by the Waters Conley Co., Rochester, Minn. The unit is electrically heated and has thermostatic and time control features. The pasteurizer is designed for use on 115-volt a.c. systems and was developed particularly for home use in suburban and rural areas.

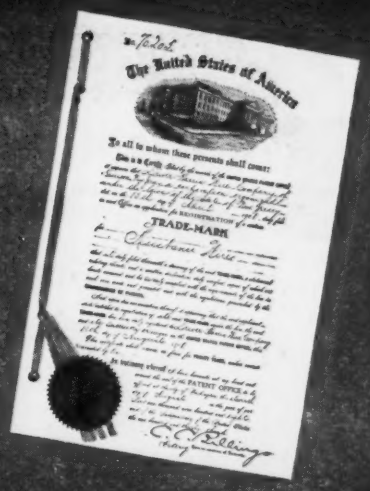
•

## Relay Hermetically Sealed In Cylindrical Can

A NEW RELAY, called Bulletin No. 108 Sensitive Relay, has been announced by Ward Leonard Electric Co., Mount Vernon, N. Y. It is of the plug-in type mounted on a standard octal plug base and enclosed in a cylindrical metal can and hermetically sealed.

The relay is provided with a normally open single pole contact having con-

# A Statement of Major Importance regarding




# Nichrome*

## *Electrical Resistance Wire*

FROM TIME TO TIME, a product is developed which—by virtue of its originality, overall superiority and general acceptance—meets with instantaneous and lasting success. In so doing, it establishes itself as the standard of quality by which all other similar products are judged.

In industry, an outstanding example of this is NICHROME.

NICHROME is a nickel-chromium alloy electrical resistance wire which is made *only* by *Driver-Harris Co.* Further, it is a *trade mark,* officially registered by the U.S. Patent Office on August 11, 1908 more than thirty-eight years ago. Its leadership in the electrical resistance field brilliantly reflects the highly specialized knowledge of technical processes and precise metallurgical controls which have made possible Driver-Harris' outstanding alloy developments for more than 47 years.

Although there are several excellent nickel-chromium alloy combinations, there is only one NICHROME—and it is made only by the Driver-Harris Co.

Remember this when next you buy electrical resistance wire. Be sure your supplier understands that you want the *genuine* NICHROME made only by *Driver-Harris,* for no other company manufactures NICHROME.

SPECIAL PURPOSE ALLOYS SINCE 1909

## *Driver-Harris* COMPANY

Exclusive Manufacturers of Nichrome

**HARRISON, N. J.**

BRANCHES: Chicago • Detroit • Cleveland
Los Angeles • San Francisco • Seattle

The B. GREENING WIRE COMPANY, LTD.
Hamilton, Ontario, Canada

*Trade Mark Reg. U.S. Pat. Off.

## —here's how to SAFEGUARD it!

**Apply carbon dioxide with a Kidde Wheeled Extinguisher**

*Kidde* Carbon Dioxide Wheeled Extinguishers combine full mobility, ease of handling and terrific fire-fighting punch.

They get to outdoor equipment and isolated danger spots *fast*, maneuver easily at the scene of the fire. Nozzles and releases are specially designed for ease of handling. Shut-off valve right on the nozzle handle allows operator to stop carbon dioxide discharge while he changes his fire-fighting position.

And with their carbon dioxide capacities of 50, 75 and 100 pounds, they take care of tough fires in a hurry!

*Remember* . . . carbon dioxide is dry, inert, non-conducting, clean.

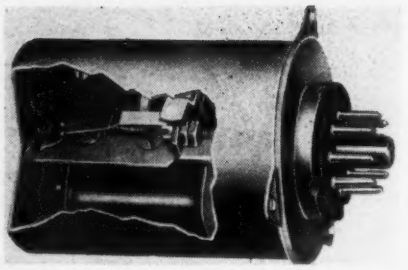
Ask a Kidde representative for full details.

**Walter Kidde & Company, Inc., 330 Main Street, Belleville 9, N. J.**

*The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.*

**Kidde**

**FIRE PROTECTION HEADQUARTERS**

tact ratings of 2 amp., 24 volts a.c. or d.c., 0.75 amp., 125 volts d.c., and 2 amp., 125 volts a.c. (A.c. ratings are for non-inductive loads at commercial frequencies).

With an average coil consumption of 0.056 watts the relays are suitable for current sensitive applications from 1.3 milliamperes to 0.54 amp. on direct current and are applicable for operation on nominal voltages from 0.1 to 48 volts d.c., the company reports.

•

### Intercom System Amplifier Taken Off Desk Top

A "TWO-STATION" intercom system designed with amplifier and speaker station in separate units, permitting off-the-desk location of the amplifier at any out-of-the-way point and reducing speaker station size has been developed by Radio Corp. of America, Camden, N. J. Speaker stations are newly styled and housed in streamlined black plastic cabinets with satin-chrome speaker grills.

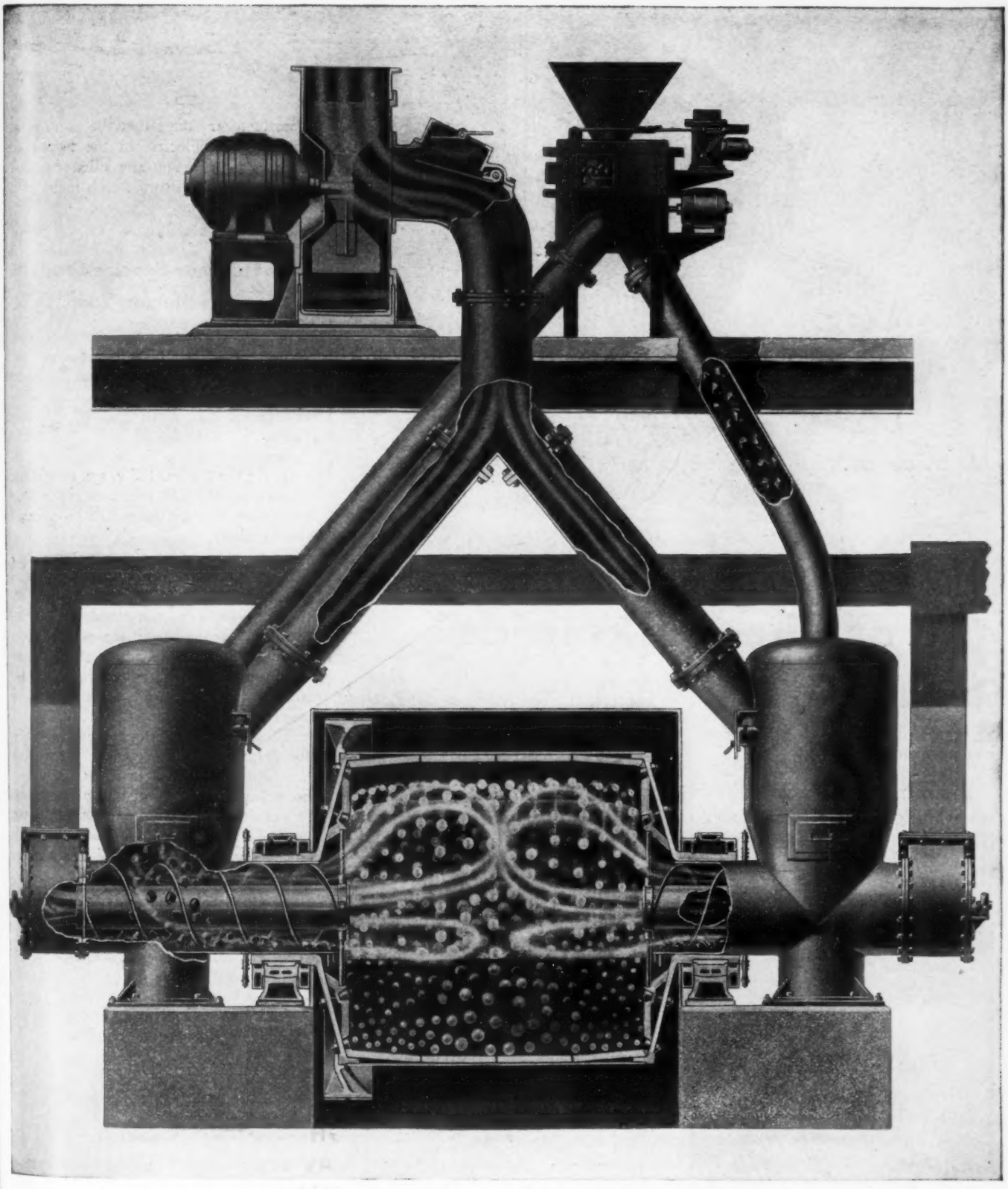
Conversation may be carried on over the new intercom at normal voice level with a flick of the two-position switch, the company reports. Releasing the switch returns it to "listen" position. A three-inch speaker is used in the speaker station, which is reported to eliminate hiss and hum.

Especially designed for two-station use, the system consists of two speaker stations, separate amplifier, and 100 ft. of interconnecting wire. It plugs into any 110-volt a.c. or d.c. outlet. If desired, additional stations up to five can be connected to the amplifier, the company states.

•

### Polyethylene Twin-Lead Eliminates Radiation

A NEW polyethylene twin-lead, No. 14-023, for connecting antenna with receiver and transmitter, has been announced by American Phenolic Corp., 1830 South 54th Ave., Chicago 50, Ill. The individual conductors, which are seven strands of No. 21 copper wire, are reported spaced to eliminate radiation as a factor up to several mc. The



Important details of ball mill pulverizer operation are shown in this phantom drawing. As the conical mill revolves, heavy steel balls pulverize the fuel particles to the desired fineness. Air drawn through the mill by an exhauster picks up the powdered fuel and carries it in suspension through the classifiers, where any heavy particles drop out. These are returned to the mill, leaving only finely powdered fuel to be carried on to the burners. As the steel balls wear, a new charge is added while the mill is in operation.

FOSTER WHEELER

# "World champ" of the milkmaids

**The beautiful** young milkmaid of fiction and poetry is a vanishing commodity.

But many a dairy farmer could wax poetic about electrical milking equipment—the "world champion" of all milkmaids!

Electrical equipment—and the availability of power has made it possible for thousands of farms to up efficiency and cut labor.

Owens-Illinois Power Insulators play an important part on many rural electrification systems by supplying efficient, economical and dependable insulation for medium voltage pole-lines.

•

Owens-Illinois Power Insulator No. 670 has been approved by the Technical Standards Committee of the Rural Electrification Administration under limits of AIEE Specification No. 41-1944. This insulator is designed for 12,000 volt lines.

Principal jobbers are making prompt shipment of all Owens-Illinois Power Insulators.

**OWENS-ILLINOIS POWER INSULATORS**

**Owens-Illinois Glass Company, Hemingray Division, Muncie, Indiana**

manufacturer states that the configuration of the dielectric in the twin-lead is such as to essentially eliminate the effect of any moisture which may form a continuous film.

•

## New Outdoor Service Control Center Usable on Yard Pole

AN OUTDOOR service control center with one or two circuit breakers for use on 2- or 3-wire circuits and enclosed in a weatherproof steel box has been announced by Westinghouse Electric Corp., Pittsburgh 30, Pa. Breaker ratings may be 10, 15, 20, 25, 35, or 50 amp. for the 2-wire, 125-v. a.c. circuit or the 3-wire, 125/250-v. a.c. circuit. The enclosure is cadmium-plated to protect the breakers.

The standard enclosures are furnished with a 1¼-in. hub at the top and two conduit knockouts at the bottom, one for 1-in., the other for 1¼-in. conduit. A 1¼-in. nipple can be provided so the control center and a standard outdoor meter socket can be nippled together and installed as a single unit.

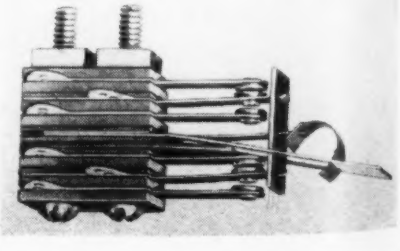
These control centers are adaptable for farmstead wiring where the meter and service control can be mounted on a yard pole. Where pole metering is not feasible or not permitted, these control centers can be mounted with the meter on the outside of a building, the company reports.

The weatherproof steel enclosure is built of code gage, deep-drawn steel. After forming and assembly, the complete enclosure is cadmium-plated and painted with outdoor grey enamel. Locking and sealing provisions have been made for both main cover and an access door to breaker handles.

•

## New Open-Blade Switch Utilizes Beryllium Spring

A NEW snap-action open-blade switch for 2-pole applications has been designed by Acro Electric Co., 1340 Su-



# LIGHTING IS CONTAGIOUS

**A 75% increase in average lamp efficiency since 1915 has been accompanied by a 1100% increase in power consumed for lighting**

You might expect that *less* power would be consumed when the efficiency of lamps is improved. That would be the case *if the same number of lamps were used* and if they were the same size and burned the same length of time each day.

But as the chart clearly shows, the lighting load increased in spite of the reduced energy requirement per lumen hour. Not only that but the increase in load has been proportionately far greater than the increase in lamp efficiency. The increase in load was greatest when rise in lumens per watt was greatest. (1940-41)

This is more evidence that good lighting is contagious.

## LUMEN-HOUR COST DOWN, USE UP

People are becoming ever more conscious of the comfort, efficiency, and pleasure provided by proper light. As the cost per lumen hour was lowered through improvement of lamps and through reduction in cost of electric energy, people bought more light.

Once better lighting is installed, it spreads. Why? Because the increased See-ability in one office, one section of a store, one department in a factory, or one room in a school is not restricted to that one locality long. People moving from the well-lighted area to a darker area notice the difference. Soon the lighting in adjoining areas and in homes is improved, too.

You will notice from the chart that the introduction of the highly efficient and economical fluorescent lamp failed to level off the rise of total lighting load. Quite the opposite was true—the quality and economy of lighting made possible by this efficient new light source accelerated the spread of good lighting by its example.

(Notice for example what happened during the first few years that fluorescent lamps were available—and the sharp upturn in 1946 when the scarcity of lamps was eased.)

## MORE LIGHT IN LARGER AREAS FOR MORE HOURS

Continuing growth of lighting is certain. The average foot candle level of illumination is less than one fourth of the practical and economic level used as a standard today.

But the real growth of lighting cannot be estimated by speaking in terms of just that one dimension, foot candles. Lighting will spread in three dimensions: higher foot candle levels will be used, they will also be used in larger areas, and they will be used for more hours. The upward trend of 1946 will continue—saturation is years away in the future

Now is the time to prepare for an all-out selling program that will take advantage of this great potential as growing supplies of equipment permit. Now is the time to be training sales personnel, to pre-sell the market, and to organize the sales campaigns that are the final pay-off. Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey.

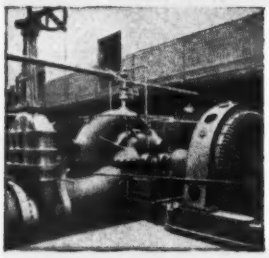
# INDUSTRY BANS RUST AND CORROSION *with* Everlasting Fastenings

Few industries can escape the destructive effects of rust and corrosion but *all* industries can reduce their costly ravages in maintenance and breakdown.

Here are five industrial applications where Harper's EVERLASTING FASTENINGS have licked rust and corrosion.

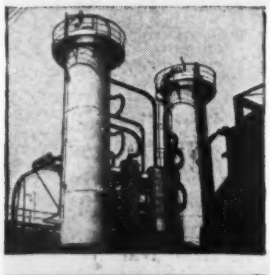
## MONEL STOPS CORROSIVE CHEMICALS

Problems in salt production have been solved by using Monel bolts. In mining, treating and handling of many chemicals, non-ferrous alloys are the answer to efficient operation.



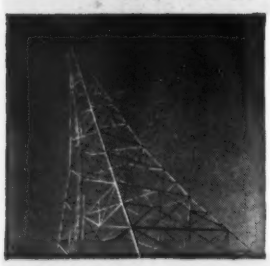
## BRASS GUARDS WATER SYSTEMS

In valves and pumps that compose the heart of water works, Brass fastenings help in eliminating the most common cause of replacement—rust.



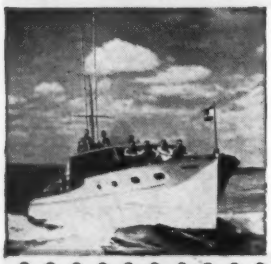
## STAINLESS STEEL SOLVES OIL PROBLEMS

Acids and gases at high temperatures attack metal but Stainless Steel alloys cut refinery replacements to a minimum, assure years of continued operation.



## UTILITIES CHOOSE SILICON BRONZE

Weather is the bug-a-boo in power lines and other utility applications. Silicon Bronze Bolts reduce season "cracking" and maintenance costs.



## NAVAL BRONZE WINS ON SEA

Marine applications demand high strength plus resistance to salt air and water. Naval Bronze fastenings have proved their dependability in marine diesels and ship fittings.

Call upon Harper to solve your fastening problems in your industry.

**THE H. M. HARPER COMPANY**
2611 Fletcher Street, Chicago 18, Ill.
Branch Offices: New York City, Philadelphia, Los Angeles, Milwaukee, Cincinnati, Dallas
Representatives in Principal Cities

HARPER
Everlasting Fastenings
Chicago


perior Ave., Cleveland, 14, Ohio. The design utilizes a beryllium rolling spring and both single and double-throw contacts.

Standard operating pressures are from 3 to 5 oz., the manufacturer reports. The switch can be furnished with terminals as illustrated, or at the rear. It is rated at 15 amp., 125 volts a.c. and has a moving differential of approximately $\frac{1}{16}$ of an inch. Over-all dimensions are $2\frac{1}{8}$ x $\frac{35}{32}$ x $\frac{3}{8}$ in.

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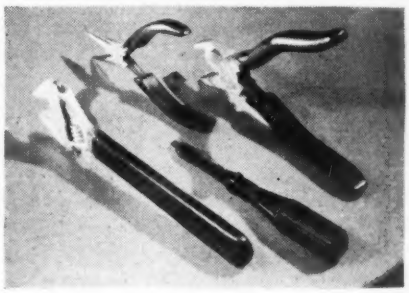
## Linemen's Pliers Handles Tested at 28,000 Volts

A NEW MATERIAL known as Cohardite has been developed by the Connecticut Hard Rubber Co., New Haven, Conn.



It is made by combining Geon polyvinyl plastic with Hycar synthetic rubber. Resultant material is reported to have good impact, oil and grease resistance, as well as good insulation properties. The material has been fabricated into many types of handles for use on tools utilized in work on energized circuits. The illustrated linemen's pliers have been tested at 28,000 peak volts.

•

## Automatic Sectionalizer Handles Up to 1,200 Amp.

A NEW automatic oil sectionalizer for sectionalizing branch lines on distribution systems using oil circuit reclosers has just been announced by the Kyle Corp., South Milwaukee, Wis. The unit, Type "GS" Automatic Oil Sectionalizer, may be used with single time current oil circuit reclosers of any type or make and may be used as fuses on systems protected by the company's Type "R" (single-phase) reclosers, which operate with dual time current characteristics.

The sectionalizer, which employs a simplified version of the Kyle hydraulic control mechanism, operates to disconnect the branch line only after one, two or three operations of the back-up recloser have failed to clear the line fault. As it does not interrupt short circuit current (contacts are open only during the no-voltage period) there is no ap-

LET BENTLEY, HARRIS WAR-TIME RESEARCH PAY DIVIDENDS FOR YOU TODAY.

# Something New in Television: Ben-Har

One of the leading television laboratories required a flexible, coated insulation of high dielectric strength. They said: "Give us tubing that will not react to heat conducted through wire . . . will not crack or split when bent . . . will not fray at the ends." They asked for a sample of Ben-Har Special Treated Fiberglas Tubing and here is what they found:

"Ben-Har Special Treated Fiberglas Tubing consistently exceeds ASTM specifications for performance. We are now specifying this material in our current television production."

Ben-Har is extremely flexible in comparison with lacquer-coated or varnish-coated Fiberglas tubings. Can be spread to cover knobs or terminals without cracking. Non-fogging. Non-corrosive. Now being used in a wide variety of applications —from hearing aids to electric motors, from watt-hour meters to movie projectors.

Try Ben-Har Special Treated Fiberglas Tubing in your own plant, in your own product—under actual service conditions. Learn why America's leading manufacturers say "never before a tubing like Ben-Har."

BENTLEY, HARRIS MFG. CO., CONSHOHOCKEN, PA.

# BH Fiberglas* SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

USE COUPON NOW

Bentley, Harris Mfg. Co., Dept. W-8, Conshohocken, Pa.

I am interested in Ben-Har Special Treated Fiberglas Tubing_____ for_____
(size) (product)

operating at temperatures of_____°F. at_____volts. Send samples so I can see for myself how Ben-Har will not crack in a bend, will not support combustion.

NAME_____ COMPANY_____

ADDRESS_____

Send samples, pamphlet and prices on other BH Products as follows:

☐ Cotton-base Sleeving and Tubing
☐ Non-fraying Fiberglas Sleeving

# What conduit assures LONGER CABLE LIFE?

ORANGEBURG* CONDUIT provides longer cable life for the following clear-cut reasons. Orangeburg's smoother bore and low coefficient of friction diminish the risk of *abrasion* when cable is pulled into duct—of *strains* from pulling tension—of *wear on sheath* from cable movement with changing loads.

Moreover, Orangeburg's tight taper sleeve joints and impermeable wall prevent *infiltration* of ground water —safeguard the cable against corrosive action.

For more complete information on this better conduit, write for Free Catalog today!

**THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.**
Graybar Electric Co., Inc. • *Distributors* • General Electric Supply Corp.

**ORANGEBURG FIBRE CONDUIT**

*Reg. U. S. Pat. Off.

**ORANGEBURG**

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

preciable wear of contacts or contamination of insulating oil, the company reports.

Over-all height is 15¾ in. The tank is 7⅛ in. in diameter. Minimum tripping current is 8 to 100 amp., maximum operating current, 150 to 1,200 amp. It may be mounted directing to the pole, on a crossarm or on a pole mounting extension bracket.

•

## Self-Leveling Ladder Base Provides Safe Climbing

A NEW automatic leveler and locking base for ladders has been developed by the Akron Steel & Sales, Inc., Akron, Ohio. The unit consists of an aluminum truss which automatically levels the ladder laterally on a half circle of steel pipe. Carborundum abrasive shoes, on ball and socket joints, are provided for gripping purposes.

The "Shur-Foot" base is reported to automatically lock itself in position after adjustment to ground conditions at the foot of the pole. The base is made in four sizes to accommodate ladder widths from 16 to 24 in. and is available for immediate delivery.

# NEWS ABOUT PEOPLE

## Detroit Edison Assigns New Duties to G. A. Porter

Organization changes in Detroit Edison Co.'s production department have been announced by Walker L. Cisler, chief engineer of power plants.

George A. Porter has been named assistant chief engineer of power plants,

G. A. PORTER

succeeding Walter D. Drysdale, who has retired after 42 years of service with the company. Mr. Porter has been with the company since 1925 in the research, construction and production departments. He was maintenance and assistant superintendent at the Delray power plant in 1942 and more recently, served in the capacity of engineer production-personnel.

Robert M. VanDuzer, Jr., has been appointed operating engineer of power plants and Virginius F. Brown has been named mechanical engineer of power plants. Henry E. Macomber has been made mechanical engineer of power plants responsible for following new construction. William W. Brown has been made engineer production-projects to assist Mr. Macomber in this work. William A. Hirt's title becomes engineer-production, load scheduling, and he continues in charge of load allocation to power plants.

Sabin Crocker has been appointed to the new position of mechanical engineering consultant. He will report in a staff capacity to Samuel M. Dean, chief engineer of the system, to undertake special assignments in the field of system engineering. Harvey A. Wagner has been appointed senior engineer-mechanical and will report to Mr. Dean. He will be responsible for the operation of the mechanical engineering section of the engineering division of the company.

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## Hotpoint Names Truesdell Marketing Vice-President

Leonard C. Truesdell has been named vice-president in charge of marketing, Hotpoint Inc., Chicago. This newly created position carries with it responsibility for all commercial phases of the company's operations, including that of general sales management.

Mr. Truesdell has long been a well-known figure in the appliance industry,

L. C. TRUESDELL

his last affiliation having been that of general sales manager of the radio division of Bendix Aviation Corp., Baltimore, from which he resigned to join Hotpoint. Previous to his connection with Bendix, he had been, for eleven years, associated in marketing capacities with the Frigidaire Division of General Motors Corp.

In announcing the appointment, James J. Nance, executive vice-president, said that this appointment is part of a program to "build a powerful marketing organization to match the greatly increased production capacity we are now acquiring."

## Kingsmill Assumes Broader Duties with Quebec Hydro

Promotion of Grange Kingsmill to be assistant hydraulic engineer and general superintendent of generating stations for the Quebec Hydro-Electric Commission has recently been announced. Charles Miller has been named Mr. Kingsmill's successor as general superintendent of the Beauharnois generating station.

Starting his career with the Quebec

G. KINGSMILL

Development Construction Co. at Ile Maligne, Mr. Kingsmill served as construction engineer and resident engineer with the Aluminum Co. of Canada, the Lake St. John Power & Paper Co., the Foundation Co. of Canada and the Beauharnois Construction Co. until 1939, his positions taking him to such places in eastern Canada as Arvida, Dolbeau, Halifax, Liverpool, N. S., and Baie Comeau. Joining the Beauharnois Light, Heat & Power Co. in 1939, he became its superintendent in 1944.

Mr. Kingsmill is a member of the Canadian Electrical Association, the Engineering Institute of Canada and the Corporation of Professional Engineers of Quebec.

Mr. Miller resigned as chief engineer of the Aluminum Power Co. Ltd. to become assistant general superintendent at Beauharnois in 1945. With Duke Price and the Saguenay Power Co. until 1936, Mr. Miller was occupied with damsite investigation for the Shipshaw

project prior to his transfer in 1940 as engineer in charge of the Lake Manouan storage dam construction. Successively, until 1945, he was acting power house superintendent of Aluminum Power's Shipshaw power house, resident engineer and chief engineer. A past-chairman of the Saguenay Branch of the Engineering Institute of Canada, Mr. Miller belongs to the Corporation of Professional Engineers of Quebec.

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## Eastern Shore Units Name Nelson General Manager

At a recent meeting of the board of directors held in Salisbury, Md., George M. Nelson was appointed general manager of all company departments and operations of the Eastern Shore Public Service Co. of Maryland, and Eastern Shore Public Service Co. of Virginia. Mr. Nelson has been vice-president of these companies since last December.

He was also appointed manager of the southern division of the Delaware Power & Light Co., which operates in Kent and Sussex Counties, Delaware.

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▶ T. E. MANSFIELD has entered the engineering department of the Central Power & Light Co., Corpus Christi, Tex., as transmission engineer. His varied experience includes 17 years with the Oklahoma Power & Water Co., Sand Springs, with which he was connected before joining Central Power & Light. Beginning as power plant superintendent, he was promoted at intervals to assistant general superintendent, general superintendent and finally vice-president in charge of electric and water operations. Prior to his association with the Oklahoma utility, Mr. Mansfield was connected with Dallas Power & Light Co. for several years in the power production department. Three years in the testing department of General Electric Co., at Schenectady, preceded the Dallas asignment.

▶ DR. S. P. DARLINGTON, former member of the War Production Board in charge of power to the Pacific Northwest, has joined the Florida Power Corp., as resident engineer for the power plants now under construction at Inglis and Benson Springs. Dr. Darlington joined Public Service Electric & Gas Co., Newark, N. J., in 1921 and from February, 1925, to July, 1927, was with Florida Power Corp. His last position before again joining the Florida utility was with General Foods Corp.

## Stainback Will Coordinate Industrial Sales Activities

Announcement has been made of the appointment of C. B. Stainback as industrial syndicate manager of the Westinghouse Electric Corp., a new position created to better coordinate the industrial sales activities of the company.

C. B. STAINBACK

Mr. Stainback, who was manager of the industrial sales department, has been with Westinghouse since 1910, the year in which he was graduated from North Carolina State College. During practically his entire business career he has been associated with sales activities in the electrification of industry.

In 1942, his contributions to the growth of the electrical industry were acknowledged with the award of the Westinghouse Order of Merit for his "untiring efforts in building industrial sales to its present high position."

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▶ PAUL H. YELTON, formerly assistant construction engineer of the California Electric Power Co., Riverside, Calif., has been appointed construction engineer to succeed E. J. WAUGH, retired. Mr. Yelton has been identified with the utility company for almost 25 years. Mr. Waugh retired from active service after 35 years of affiliation with California Electric Power, its affiliated companies and predecessors.

▶ ALBERT W. GRAY, assistant to the president, Hartford Electric Light Co. for the past 21 years, and formerly chairman of the board of the Hartford Electric Steel Co., has retired from active service. Mr. Gray was educated at the Massachusetts Institute of Technology, and in his earlier career was engaged in civil engineering in New England and the West, later becoming construction engineer for the Colorado Power Co., and then a construction superintendent for the Stone & Webster Engineering Corp., Boston. During World War I he was for a time works manager of Harvey Hubbell, Inc., Bridgeport, Conn., and later of the Billings & Spencer Co., Hartford, and the Bristol (Conn.) Brass Co. He joined Hartford Electric Light in 1926.

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## Corporate Changes Made by Brazilian Traction Co.

Following a meeting of the board of directors of Brazilian Traction, Light & Power Co., Ltd., in Toronto, announcement was made that Rt. Hon. Sir Thomas White, A. W. K. Billings and S. G. Crowell had resigned.

Sir Thomas White and Mr. Billings have been associated with the company almost since its inception, Mr. Billings also having acted formerly as president of the company and having contributed substantially to its present extensive hydroelectric development.

Vacancies have been filled by the appointments of Lt. Col. W. E. Phillips, Beverley Matthews and H. B. Style. Colonel Phillips is president of Duplate Canada Limited and Fiberglas Canada Limited, Oshawa. Mr. Matthews is a member of the legal firm of McCarthy & McCarthy, Toronto, and Mr. Style is president of the subsidiary companies of the Brazilian Traction, Light & Power Co., Limited, operating in Brazil.

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▶ DONALD C. KETCHAM has been named assistant power manager for the Reclamation Bureau's Region 6, covering North and South Dakota and parts of Montana and Wyoming with headquarters at Billings, Mont. Mr. Ketcham was a regional power supply engineer handling New York State and New England for the Office of War Utilities during the war. He began his career with the Potsdam (N. Y.) Electric Light & Power Co. in 1917 and connections in the succeeding years have included the Westinghouse Electric Corporation, the Aluminum Co. of America, Tennessee Electric Power Co., Commonwealth Edison Co., Spooner & Merrill, consulting engineers of Chicago, and Black and Veatch. Thereafter, he spent a short time with the Tennessee Valley Authority, with the Rural Electrification Administration and then with the War Production Administration. Thereafter for several

# There's a CHANCE

(FORMERLY KNOWN AS "TIPS")

# Grounding Set

## *for every Overhead and Substation Requirement*

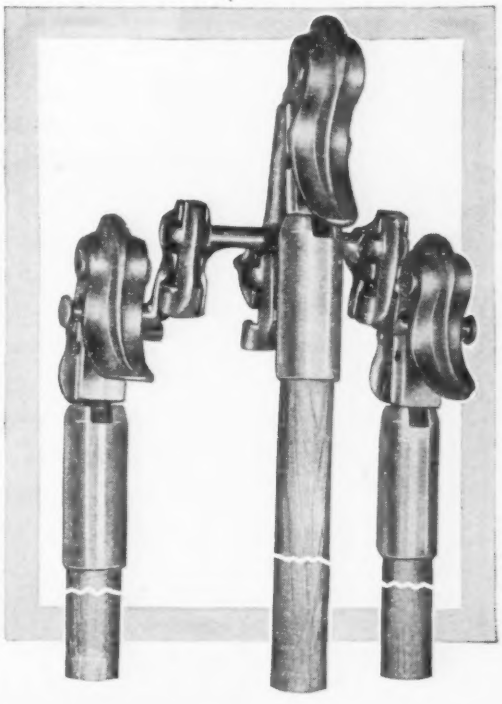
### Dependable Protection on all types of jobs—For Single-phase Lines up to Heavy Substation Bus Bars

For ample protection to linemen making repairs on "cold" lines, Grounding Equipment should make tight contacts at all points—maintain high conductivity and provide insulation protection during application. You get all this in every type and size and a few plus features, when you specify Chance Grounding Equipment.

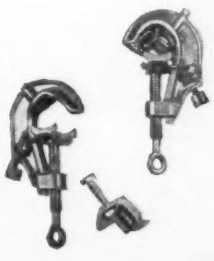
Single clamps or combination sets are available for all types of highline or substation work with mechanical and electrical characteristics to meet every requirement. Clamps or clusters of clamps may be obtained, either mounted on poles or unmounted, for application with clamp sticks. This equipment is designed by experts and thoroughly tested to provide the protection that your linemen should have against unexpected current surges.

The clamps snap on with minimum arcing and screw up tight on the conductor by turning the poles or eye screws. Jumper pressure contacts are pre-tightened with a wrench. There are no loose contacts as when hazardous grounding chain is used. All parts are carefully tested to meet high Safety Standards. All poles are laminated for strength and tested to resist 75,000 volts per foot.

Complete details on Chance Grounding Equipment will be found in the grounding section of your Hot Line Tool Catalog No. 8.



Mounted Grounding Sets like the above give definite protection to linemen as they eliminate the danger of clamps being applied by hand. All sets are available with cable attached.



Substation Bus Bar Clamps and combination sets are made in varied types and sizes for flat or round bus bars. The eye screw clamps at right have removable bronze inserts that make them adjustable to fit a number of different sized bus bars. These, too, are available either mounted or unmounted.

C471

ABC INDUSTRIES

# A·B·CHANCE CO·

CENTRALIA, MISSOURI.

SAN FRANCISCO, CALIFORNIA

**WHY You Should Specify "PENTA" PRESERVATIVE TREATMENT...**

***for your poles, cross-arms and other exposed wood***

1. Chapman "Penta" Preservative is *clean*—not sticky or unpleasant for linemen and other workers. In fact, with proper choice of solvent carrier, it is possible to treat wood thoroughly with "Penta" Preservative and have it virtually the same in appearance and feel as untreated wood.

2. Ten year tests prove that Chapman "Penta" Preservative gives you superior protection against rot, termites and other enemies of wood. No other material commercially available today can do a better job.

3. Chapman "Penta" Preservative costs no more than familiar materials, and treatment is applied with the same equipment and in substantially the same way as old-fashioned preservatives. That means you can buy treated poles and cross-arms—or have your own material properly treated—in any part of the U.S.

Write us for details and evidence to confirm the statements made above.

**CHAPMAN**

**CHAPMAN CHEMICAL COMPANY**
**Suite 542**
**333 North Michigan Avenue, Chicago 1, Illinois**

Chapman "Penta" Preservative contains *Pentachlorphenol*
a product of
*The Dow Chemical Company*


months he was chief of the Utilities Section of WPB's Controlled Materials Branch and then became identified with OWU's power supply staff. After leaving OWU, Mr. Ketcham returned to REA as assistant regional head of REA's management division, the position he held until his transfer to Reclamation.

•

## Noma Electric Corp. Elects Four New Vice-Presidents

Appointment of four new vice-presidents of Noma Electric Corp. has been announced. They include: Walter E. Fleischaker, Bernard E. Fleischaker, David Kahn and Joseph L. Kallus.

Messrs. Fleischaker were owners of Fleischaker & Baum, Inc., manufacturers of the EFFanBEE dolls, which business was absorbed by Noma last year. Mr. Kahn was formerly president of Estate Stove Co., also absorbed by Noma last year, and Mr. Kallus was formerly owner of the Cameo Doll Products Co., whose products for the past four years have been sold by Noma.

Appointment of Allen W. Wexler as sales manager of the Pacific Coast district, in charge of toys, decorative lighting, novelties, heaters, wire and cable has been announced. Mr. Wexler's headquarters will be in Los Angeles.

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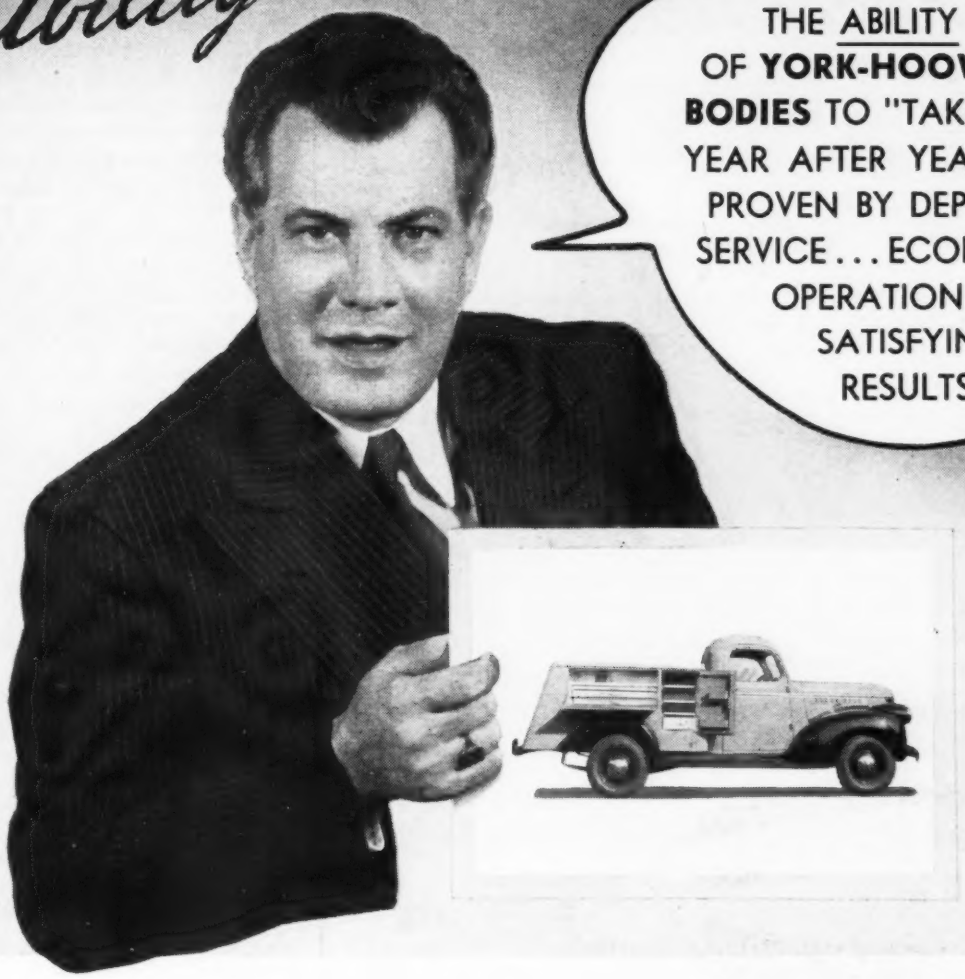
▶ W. W. ECKLES, formerly electrical engineer of the Gulf States Utilities Co., Beaumont, Tex., has been appointed planning engineer. R. W. SHERWOOD, formerly standards engineer, has been promoted to the position left vacant by this change, with the title of design engineer.

▶ JAMES H. MCGUIRE, supervisor of adequate wiring in the Atlanta division of Georgia Power Co., has been appointed acting division rural engineer in addition to his other duties, during the temporary absence of P. C. Lynch.

▶ WILLIAM R. SNYDER has returned to the Philippines to rejoin the Manila Electric Co. As electrical manager he will be concerned with the reconstruction of a war-torn utility, although the system is now reported to be serving a record-high load from emergency floating generating plants.

▶ SAM BUNDRICK was elected chairman of the Crisp County (Ga.) Power Commission to succeed W. R. TURNER, who retired on January 1. Mr. Bundrick has been a member of the Board of Commissioners for several years. C. L. MCMILLIAN, county commissioner, was elected vice-chairman. HOLT WALTON

# *Ability and Dependability*




For over 55 years sound engineering and skilled craftsmanship have been the basic factors contributing to the reliable performance of York-Hoover bodies . . . factors, too, that have earned and maintained the valued confidence of our good friends and customers.

BODY DIVISION

## YORK-HOOVER CORPORATION

YORK, PENNSYLVANIA

# Economical POWER

## can improve your PROFIT PERCENTAGE

**Forward-looking industrialists and utility executives are seeking to hold the essential profit line in the face of rising labor and supply expense. They recognize improved plant efficiency as the principal factor in doing so. To obtain the maximum benefits offered by new developments, modern facilities and sound application ingenuity, management turns to experienced engineering counsel.**

## DESIGNING • ENGINEERING • CONSTRUCTION • PIPING

**J. F. Pritchard and Company renders services to utility and industrial clients in all parts of the country, concerning every variety of problem relating to electric power and steam. This vast experience is brought to bear upon every undertaking of Pritchard's Power Division, whether it is a minor piping installation or a complete plant.**

**Complete Plants • Additions • Installations • Every detail geared to more profitable operation, at the lowest possible cost.**

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**J.F. Pritchard & Co.**
ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL, PETROLEUM, GAS & POWER industries

New York · Chicago · Houston · St. Louis · Tulsa · Pittsburgh · Dallas · Detroit
Omaha · Denver · Atlanta · St. Paul · Salt Lake City · El Paso · Mexico City


and MARVIN MCKINNEY were sworn in as new commissioners, and S. C. BYRD, SR., who has served on the board for 14 years, was reelected for another term on the board.

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## Westinghouse Announces Engineering Appointments

J. A. Butts, manager of the standard control division of the Westinghouse Electric Corp., has announced several personnel appointments as one of the first steps in moving the division from East Pittsburgh to the company's newly acquired plant in Beaver, Pa.

C. A. Pickering will be manager of manufacturing; Leland G. Atkinson, works engineer; Eric Perry, superintendent of manufacturing; R. W. Scott, sales manager; G. C. Woodward, order service manager, and L. W. Dyer, engineering manager.

Mr. Pickering has been connected with Westinghouse since 1920. With a broad background of manufacturing activity including production, plant planning, cost analysis and time study, he progressed from assistant foreman to superintendent of manufacturing in the switchgear division.

Mr. Atkinson joined Westinghouse in 1933. Previously a general foreman in the switchgear division, Mr. Perry brings to his new position wide manufacturing experience. Mr. Scott has been associated with the company's construction industry section at headquarters and the Cleveland, Ohio, sales office. Mr. Woodward began work at Westinghouse in 1926 and has served in various engineering capacities. Mr. Dyer joined Westinghouse in 1925 and has been identified with engineering activities in the switchgear division since that time.

Appointment of A. Carl Bredahl as manager of the better homes department has been announced. Technical director of the company's better homes department for the past two years, he has been active in promoting better electrification for homes. He wrote the Westinghouse Home Wiring Handbook and has been active in association work.

S. H. Harrison, formerly manager of machinery electrification, Pacific Coast district, has been appointed Pacific Coast manager of the industrial division, with headquarters in San Francisco.

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▶ LEO L. HELTERLINE, JR., has been appointed chief engineer for Sorensen & Co., Inc., Stamford, Conn. In his new capacity, Mr. Helterline will be responsible for the design and development of all Sorensen products, which include voltage regulators, transformers,

TROUBLE PREDICTED

# COMPLAINTS FORESTALLED

DEFECTS REVEALED

Bristol's All-Purpose Portable Voltmeter gives you a convenient means of quickly analyzing conditions, making voltage surveys, general testing, investigating complaints — helping you to maintain a high standard of voltage regulation.

Double-record Voltmeters help check the balance on three-wire systems and to study voltage drop in a section of the circuit.

Three-record Voltmeters are used in investigating conditions in three separate circuits or in polyphase networks, and for determining voltages at load centers and ends of feeders.

**BRISTOL'S ALL-PURPOSE PORTABLE VOLTMETER**

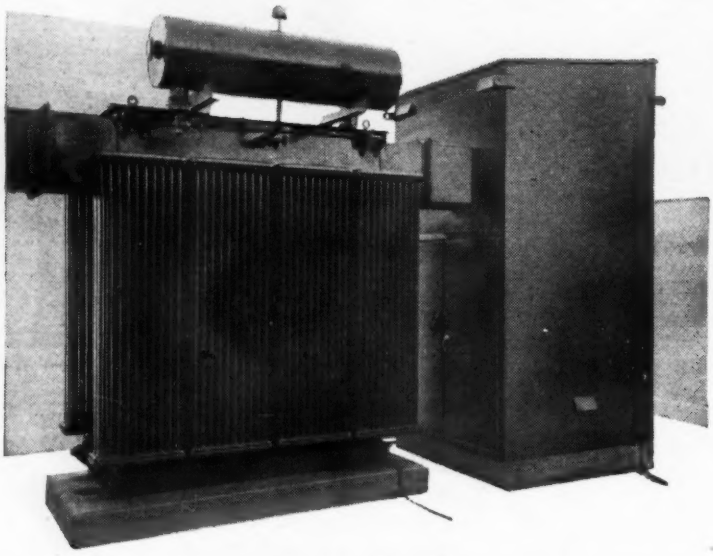
Easy to handle — weighs only 17 pounds. Can be carried anywhere, mounted anywhere — outdoors or on a damp cellar floor. Will take constant handling without affecting accuracy.

Bulletin E1100 describes replaceable measuring element, gravity-controlled pen pressure, fine-bore platinum-tip fountain pens, integral resistors. Address THE BRISTOL COMPANY, 116 Bristol Rd., Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont. Bristol's Instrument Co., Ltd., London, N. W. 10, England). Makers of Metameter, Recording Ammeters and Voltmeters, Thermoverter, and a broad line of automatic controlling and recording instruments.

*Gives You the Facts when and where you want them*

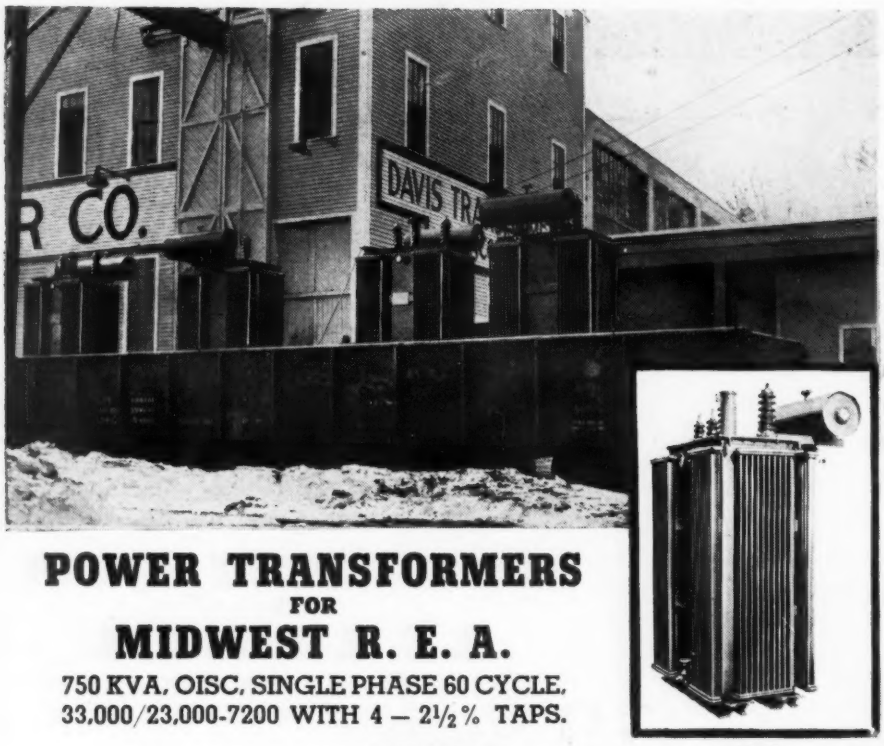
AUTOMATIC RECORDING AND CONTROLLING INSTRUMENTS

DAVIS
TRANSFORMERS



2000 KVA, OISC, 60 CYCLES, THREE PHASE 13800-480, 10% TAP RANGE, THROAT CONNECTED TO SWITCH GEAR ON HIGH VOLTAGE SIDE AND BUS RUN ON LOW VOLTAGE SIDE.

Power Transformers




POWER TRANSFORMERS
FOR
MIDWEST R. E. A.
750 KVA, OISC, SINGLE PHASE 60 CYCLE,
33,000/23,000-7200 WITH 4 — 2½% TAPS.

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TRANSFORMER CO.
Phone 177 CONCORD, N. H.
MANUFACTURERS OF OIL COOLED, DRY TYPE, POWER AND DISTRIBUTION TRANSFORMERS

and special electronic equipment. He has been with Sorensen since January, 1946, as senior project engineer. Prior to joining Sorensen, Mr. Helterline was affiliated with Sylvania Electric Products Inc.

## OBITUARY

▶ EVERETT B. COLLINS, an operating engineer of the New England Power Co. with headquarters at Boston, Mass., died at Fort Myers, Fla., on February 26. He was born in Brockton, Mass., in 1889, and was graduated from Worcester Polytechnic Institute in 1910. He joined the New England Power System in 1916 as an electrical engineer and for an extended period was identified with the development of the retail properties, being transferred to the engineering staff in Boston in 1936.

▶ JOSEPH P. KUNKEL, formerly superintendent of the Jasper, Ind., municipal light and water plant, died at his home in that city on February 26. Mr. Kunkel was the first superintendent of the plant. He was 65 years old.

▶ BRYAN L. KETHLEY, division manager of the South East Joslyn Co. at Jacksonville, Fla., died at his home in that city on February 2 in his sixty-second year. A native of Crystal Springs, Miss., Mr. Kethley had been an associate of the South East Joslyn Co. for 19 years. At the time of his death he was in charge of the pole-line equipment company's offices in Jacksonville, Atlanta, Ga., and in Birmingham, Ala. Mr. Kethley was a member of the American Institute of Electrical Engineers.

▶ CHARLES A. SINCLAIR, retired Southern California Edison Co. district superintendent, died on December 11. He had joined the Edison Co. in 1909 and retired in 1935.

▶ JAMES B. KAY, who served for 37 years as an electrical engineer with the B. C. Electric Railway Co., Vancouver, B. C., died at his home in that city recently. He was 85 years old. Mr. Kay was born in Lancashire, England, and came to Canada as a young man.

▶ EARL P. MARKEE, General Electric lamp department manager in Los Angeles since 1919, died on February 2. Mr. Markee was born in Minneapolis, Minn. in 1891. He joined the General Electric Co. in 1916 at Portland, Ore., and went to Los Angeles three years later, to become manager of that office. He was a past-president of the Los Angeles Electric Club.

# Here's why

*With the finest modern microscope Chase metallurgist checks uniformity and grain size of Chase Antimonial Admiralty condenser tubes.*

## CHASE ANTIMONIAL ADMIRALTY*

***helps reduce annual replacement cost of condenser tubes . . .***

YOU get longer service life from condenser tubes made with Antimonial Admiralty. That's because of the remarkable resistance of this patented Chase copper alloy to dezincification.

Millions of pounds of Antimonial Admiralty have been installed since Chase developed it in 1935. Scarcely a single service failure from dezincification has been reported. The power engineer can appreciate what a saving this represents in annual tube replacements.

You would expect to pay more, most likely, for a condenser tube of such quality. Actually, the initial cost of Chase Antimonial Admiralty tubes is no greater than for plain Admiralty. For information phone the nearest Chase Warehouse or Service Office.

*U. S. Pat. No. 2,061,931

**Special stocks of ANTIMONIAL-ADMIRALTY Condenser Tubes in Chase Warehouses at LOS ANGELES, NEW ORLEANS SAN FRANCISCO**
*also carried by—*
**Vinson Supply Co., TULSA**
**Standard Brass & Mfg. Co. HOUSTON**

# Chase
## BRASS & COPPER CO.
INCORPORATED

**Waterbury 91, Connecticut**
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

*This is the Chase Network—handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS JACKSONVILLE† KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Indicates Sales Office Only)

# MANUFACTURERS & MARKETS

## NEMA's 1947 Water Heater Campaign Features Utility and Plumber Benefits

The Electric Water Heater Section of the National Electrical Manufacturers Association will build its 1947 advertising program around two separate trade campaigns, it was announced by C. J. Coward, director of advertising and sales promotion of the Kelvinator Division of Nash-Kelvinator Corp., Detroit, chairman of the NEMA water heater advertising committee.

During the past four years, the electric water heater message was directed primarily to architects and builders. This phase of the advertising program will be continued throughout 1947, and, in addition, a new campaign will be introduced to reach the plumbing industry. Both campaigns are getting underway, according to the announcement made by Mr. Coward.

"The basis of the campaign," said Mr. Coward, "will be advertisements, featuring testimonial letters from Master Plumbers. These letters definitely show that plumbers have found the sale and installation of electric water heaters a highly profitable business."

"One or more of these plumbing trade papers will carry the electric water heater message each month in 1947, reaching a potential readership of over 50,000 plumbers and their assistants," continued Mr. Coward.

***Brochure a Feature***

One of the highlights of this promotion is an eight-page brochure, "The Modern Automatic Electric Water Heater," recently released to electric power suppliers across the country. This booklet was designed to help promote the sale of electric water heaters at the local level. Utilities and power suppliers have received this promotion so enthusiastically that a large second edition is being reprinted and will be ready for distribution shortly.

To implement the plumber campaign, a comprehensive plan book, "You Need The Plumber," containing electric water heater promotional material and advertising tie-ins designed to help utilities enlist the cooperation of plumbers in building electric water heater sales, will be released shortly for use by the power sales groups.

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### Form Electrical Apparatus Company in Virginia

Property has been purchased in Arlington, Va., by the Shull Electric Products Corp., for the manufacture of electrical distribution and control apparatus. This new Virginia corporation has purchased assets of the Shull Co. of Washington, D. C., engaged in a similar activity for the past 40 years

The former president of the Shull Co. of Washington, D. C., Frank T. Shull, will serve as president of the new corporation. Other officers and directors of the new company will be Thomas S. Shull, son, who has been associated with his father in the electrical manufacturing business since his graduation from Cornell University and a new member of the firm, Richard C. Lipps. Well-known in the electrical industry, Mr. Lipps was formerly manager of the West Works of the Trumbull Electric Manufacturing Co. of Plainville, Conn., going to the Trumbull organization in 1930 from Hollis French and Allen Hubbard, consulting engineers of Boston, Mass. With the exception of three years in military service, he has been associated with the Trumbull organization since that time in an executive capacity.

The corporation will move from their present location to the new expanded facilities the latter part of March.

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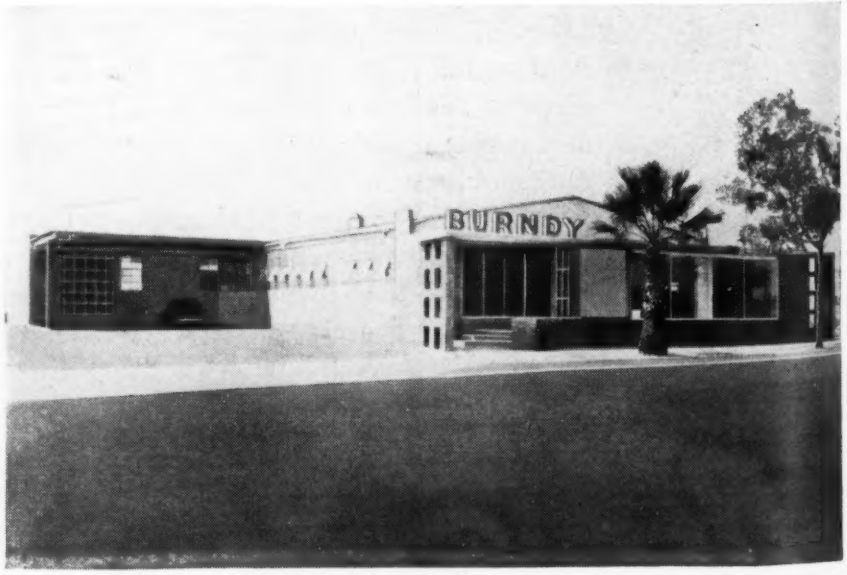
### American Relay & Controls Acquires Allied Control Co.

American Relay & Controls, Inc., Chicago, has acquired all equipment and personal property of the Chicago division of Allied Control Co., Inc. Production of electrical relays, switches and controls will be continued on an increased scale, I. G. Grawoig, who heads American Relay & Controls, stated. The




**OPENS WEST COAST PLANT—To provide service for the increasing number of electrical connector users in the western states, Burndy Engineering Co. has opened a new factory and warehouse in Vernon, Calif. The new plant will manufacture many of the connector types which are also produced at the company's main factory in New York**

This advertisement is reaching an audience of 2,200,000 consumers and executives

• READERS OF •

Time Magazine and United States News

...featuring another electrical product that utilizes FIBERGLAS' exclusive advantages

...it's another example of why the swing is to FIBERGLAS

...Another reason why more and more people are:

**Asking for Fiberglas in the things they buy—considering its superior qualities to improve the things they make.**

## Kilowatts are coming to this house ...wrapped in glass!

They needed more cable for home building. They needed rugged, sturdy cable to carry the heavy electrical load that homes require today.

So electrical engineers took their clue from a host of wartime marine and naval uses—where glass, Fiberglas electrical insulation materials, had done a vital job.

And then a new development was born —building cable *wrapped in Fiberglas yarn* —strong, flexible, fire and moisture-resistant, economical, easy-to-install.

Today, this new electrical application of Fiberglas yarn has taken its place in America's vital home building program. It adds its values to those other Fiberglas products making important contributions to good construction and better living—home insulation, refrigerator, range, water heater insulation, "Dust-Stop" air filters for modern warm air furnaces.

Fiberglas is the trade-mark for this electrical insulating material, and for a long list of products made of light, strong, heat and moisture-resistant, ageless glass in pliable fiber form.

Ask for Fiberglas in the things you buy. Consider its superior qualities to improve the things you make. For information about this Fiberglas product, write to Owens-Corning Fiberglas Corporation, Dept. 801, Toledo 1, Ohio. Branches in principal cities. *In Canada: Fiberglas Canada Ltd., 1200 Bay St., Toronto, Ontario.*

OWENS-CORNING FIBERGLAS

Write for information about building cable wrapped in Fiberglas yarn. And, if you design, specify or use electrical insulating materials, be sure to have a copy of catalog EL46-11. Owens-Corning Fiberglas Corporation, Dept. 858, Toledo 1, Ohio. Branches in principal cities. *In Canada: Fiberglas Canada Ltd., Toronto 1, Ontario.*

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ELECTRICAL INSULATIONS

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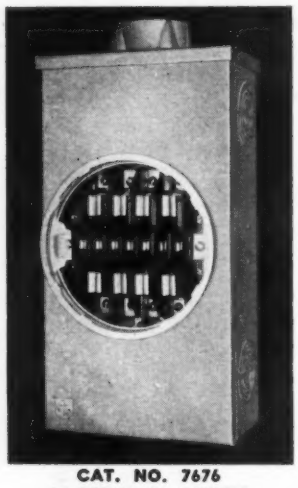
FOR BOTTOM TERMINAL OR BACK CONNECTED METERS

INDOOR
OUTDOOR



SINGLE PHASE
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15 TERMINAL SOCKET

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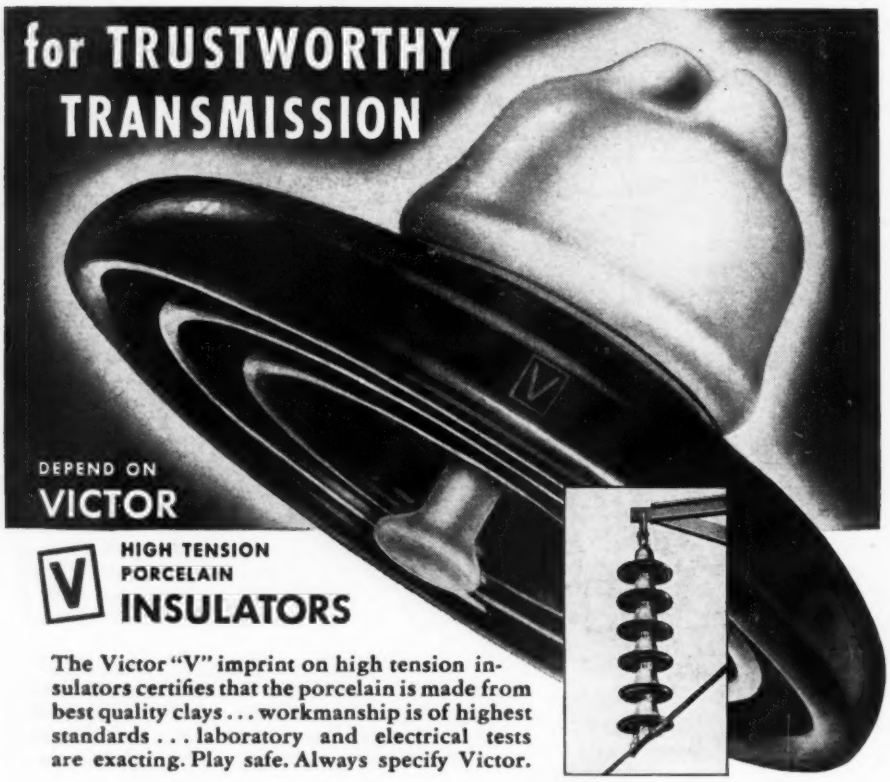



V HIGH TENSION PORCELAIN INSULATORS

The Victor "V" imprint on high tension insulators certifies that the porcelain is made from best quality clays . . . workmanship is of highest standards . . . laboratory and electrical tests are exacting. Play safe. Always specify Victor.

VICTOR INSULATORS, INC.

VICTOR, NEW YORK

*BIRTHPLACE OF FIRST WET PROCESS HIGH-VOLTAGE INSULATORS*

entire present personnel of the company, including about 350 employees, is being retained.

•

## Bendix Plan Puts Service Training Ahead of Sales

Service training has been placed ahead of sales education in the home appliance field development campaign of Bendix Home Appliances, Inc., A. A. Smith, field service supervisor, revealed, as the company's training program was launched recently in New York.

The new Bendix automatic home dryer and automatic ironer are to be in mass production soon, he said, and field sales education campaigns will be started for distributors this spring, after the nation-wide program of service education has been completed among all Bendix dealers and distributors.

Placing service education ahead of sales has several important advantages from the manufacturers' point of view, Mr. Smith said, since (1) it keeps training and service methods ahead of maintenance problems, (2) it removes the largest obstacles of sales resistance for salesmen, since prospective customers are completely reassured that service is available when they see a new machine, (3) it reduces costs of maintenance to household buyers, because repairmen know what they are doing.

•

## Electronic Test "Lab" Set Up by Bureau of Standards

A new laboratory to test Geiger-Müller Counters and associated electronic equipment has been established in the Radioactivity Section of the National Bureau of Standards. The laboratory will test performance qualities, utility, and construction of counters now being manufactured.

It will aid purchasers by assisting them in formulating of specifications; and manufacturers by accumulating test data and by determining the type of counters necessary to various fields of scientific research. No attempt will be made at present to set up standard specifications because of lack of uniform types and design of counters.

•

## Award $114,100 for Ideas

Cash awards totaling $114,000 were paid out by General Electric Co. last year for ideas submitted by employees. This brought to $2,110,000 the amount the company has paid workers for suggestions since the plan was inaugurated in 1922.

## Fractional-Hp. A. C. Motor Shipments Rise 150%

Announcing that the 1946 shipments of fractional-horsepower a.c. motors totaled 19,546,599 units, the Civilian Production Administration stated that monthly shipments had climbed from 873,376 in January, 1946, to 2,117,943 in December.

This increase of almost 150 percent in the monthly shipment rate was attributed by CPA to the cooperation of industry and government in breaking one of the most serious bottlenecks in the production of a wide variety of civilian goods.

Responsible for much of the rise in the delivery rate of these motors was the equitable distribution to motor manufacturers of silicon sheet steel, copper magnet wire, castings and insulation materials.

One of the most pressing problems of the year was presented by the unprecedented requirements for small motors for veterans' housing. This demand reached a peak in September. Manufacturers agreed to increase production of the types of motors used in warm air furnaces, and, by direction, CPA diverted motors from new furnace manufacturers into veterans' houses already erected and ready for occupancy except for home heating systems.

Despite the accelerated rate of small motor shipments in 1946, the year ended with a backlog of 40,266,000 unfilled orders, or the equivalent of 19 months' shipments at the December rate.

CPA officials declined to forecast how great an inroad may be made in this backlog in 1947. They pointed out, however, that production is still increasing and may reach a maximum of 2,750,000 units a month in the third quarter. At the same time, order cancellations are increasing.

| Month (1946) | Shipments (Units) | Unfilled Orders (Units) | Backlog* (Months) |
|---|---|---|---|
| January | 873,376 | 24,093,148 | 27 |
| February | 849,942 | 26,979,554 | 30 |
| March | 1,163,881 | 30,275,343 | 26 |
| April | 1,508,427 | 30,884,665 | 20 |
| May | 1,653,744 | 31,682,072 | 20 |
| June | 1,610,256 | 32,881,908 | 20 |
| July | 1,681,342 | 36,112,913 | 21 |
| August | 1,781,175 | 37,728,698 | 21 |
| September | 1,907,932 | 39,684,941 | 21 |
| October | 2,136,840 | 41,886,662 | 20 |
| November | 2,261,741 | 39,767,381 | 17½ |
| December | 2,117,943 | 40,266,220 | 19 |
| Total Shipments | 19,546,599 | | |

* Backlog is based on the respective month's rate of shipments.

•

## RCA Gets $40 Million Credit

A $40,000,000 two-year credit agreement has been entered into by Radio Corp. of America with a group of 24 banks throughout the country, with the option that the agreement may be extended to a ten-year period. David Sarnoff, RCA president, disclosed in the 1946 annual report to stockholders just issued. Purpose of the credit is to provide funds for working capital desired for plant expenditures and for increased inventories.

•

## Manufacturers Announce Plant Expansion Plans

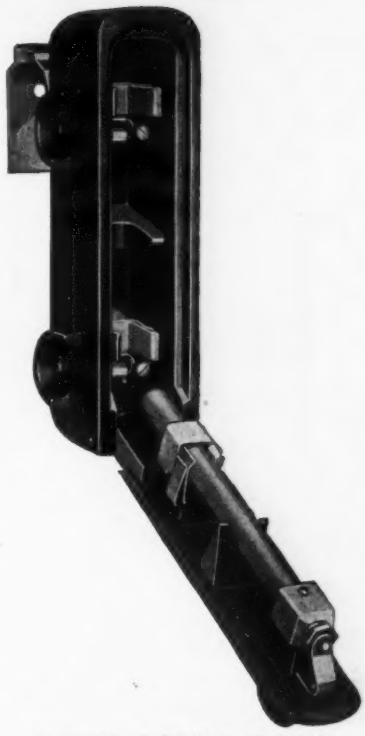
Purchase of 27 acres in Little Rock, Ark., for construction of an incandescent lamp manufacturing plant has been announced by Ralph C. Stuart, vice-president of Westinghouse Electric Corp. in charge of the company's lamp and lighting divisions. Excavation is expected to get underway in about three months and initial production of lamps is tentatively scheduled for December, 1947. It is estimated that 800 persons eventually will work in the 150,000 sq. ft. of floor space planned for the building. Except for a few key executives, personnel for the plant will be recruited from Little Rock and surrounding communities. Expansion of its lamp manufacturing facilities by the Little Rock acquisition is part of a $132,000,000 production expansion program announced earlier by Westinghouse.

Work has been started on a new four-story addition to the plant of the General Radio Co., Cambridge, Mass. This new building, located at the corner of State and Windsor Sts. in Cambridge, will add approximately 30,000 sq. ft. to the company's manufacturing space, bringing the total plant space to 140,000 sq. ft. It will be used to house manufacturing operations now being carried on in rented quarters and will also provide space for an increase in manufacturing capacity.

General Electric Co. appliance and merchandise department has purchased a 437,000-sq.-ft. factory in Lowell, Mass., from the War Assets Administration. The second Lowell plant to be acquired by the department within six months, the new Marginal Street plant, formerly occupied by the U. S. Rubber Co., will be used for the manufacture of building wire and other electrical construction materials. The plant will be under the direction of S. T. Powell, manager of manufacturing of the G.E. wire and cable division, with headquarters at Bridgeport, Conn.

Minneapolis-Honeywell Regulator Co. has opened a new and greatly-enlarged headquarters building at 2840 East Olympic Blvd., Los Angeles. The new building will house all divisions: heat-


**Non-Indicating Porcelain Housed Matthews Cutouts.**



ALMOST AS SIMPLE AS A PIN.

**Ratings**
**50 and 100 Amperes**
**5 and 7½/12½ Kv Grd. Y**
**Interrupting Capacities**
**1200 and 3000 Amperes**

WHY THEY ARE LIKED

Simple* — Rugged — No Moving Parts — Heavy Everdur Set Screws — All Current Carrying Parts Over 85% Copper Content — Time-seasoned Bakelite Covered Fibre Fuseholder Tubes Which Won't Warp — High Flashover Values — High Interrupting Capacity — Lowest Time-cost — Over 500,000 In Use. No essential changes in design in over fifteen years, but many refinements have been made.

*Remember: Simplicity means freedom from operating troubles.

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BIG 10-ROLL CAN of the BEST BUY IN TAPE

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Whatever way you buy tape, you'll find Gold Seal always just right in "tack"; clean handling; non-raveling; non-peeling. Jenkins Bros. (Rubber Div.) 80 White St., New York 13.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

JENKINS Gold Seal Tape FRICTION - RUBBER

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

FOR OUTAGE PROBLEMS ON RURAL LINES

★ Locate Faults Faster

★ Restore Service Sooner

with Raytron Electronic FAULT LOCATOR

You can locate ground faults within one span without climbing poles with the Raytron Electronic Fault Locator. Simply energize the circuit from the section break with a capacitor and carry the Raytron Locator along the line. At line intersections or lateral taps the locator meter will tell you which way to drive and point out the fault within one span. The Locator will operate up to 100 yards from the line.

The Raytron Method of tracing faults saves many hours locating ground faults on all types of overhead distribution lines. Invisible storm damage, damaged lightning arrestors and other hard-to-locate faults can be found quickly. Not affected by weather.

Get proof that Raytron Locator will locate faults faster and help you restore service sooner. Ask for a demonstration of Raytron Electronic Fault Locator. You will not be obligated. Write Today.

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ing and air-conditioning controls, industrial, aeronautical, contractor, original equipment and jobber-dealer.

•

## BullDog Electric Celebrates Forty-Fifth Anniversary

Developing from a 15-man plant in Wheeling, W. Va., to a great manufacturing business in Detroit, the BullDog Electric Products Co. this year celebrates its 45th anniversary.

BullDog was established in 1902 as the Mutual Electric & Machine Co., in Wheeling, W. Va., manufacturing electrical control and distribution apparatus for the steel industry in the Allegheny Valley. The famous BullDog was then merely a trademark selected to convey the toughness and endurance of an early knife-type switch. In 1915, the company moved to Detroit to better satisfy the fast-expanding electrical needs of the automotive industry. The company outgrew two plants in the next few years, and in 1923 moved to its present eight-acre site at Joseph Campau Avenue at Dunn Road. In 1927 the trademark was graduated to company name; and the Mutual Electric & Machine Co. became the BullDog Electric Products Co.

In the years immediately following, the company pioneered the prefabricated busway system for electrical distribution, called BUStribution Duct. It also introduced two complementary busway systems—industrial Trol-E-Duct, which made it possible to safety power cranes, hoists and high cycle portable electrical tools "on the run;" and Universal Trol-E-Duct, whose continuous electrical outlet made it possible to add, remove or shift lights with astonishing ease.

•

## Prepare Educational Show, "The Evolution of Tone"

An educational program, tracing the development of the phonograph and the radio-phonograph combination over more than half a century, has been prepared by the receiver division of General Electric Co. and will soon be released to field offices for public demonstrations in all parts of the country, Arthur A. Brandt, general sales manager, electronics department, has announced.

The show, titled "The Evolution of Tone," has been prepared to appeal to all types of audiences from school groups to business men's luncheon and dinner assemblies. Scripts are being provided to make the program of special interest also to radio distributors, dealers and servicemen.

*Announcing*

# BRITISH INDUSTRIES FAIR

## LONDON & BIRMINGHAM, MAY 5—16, 1947

This is your first opportunity in seven years to see your old suppliers in Britain and to meet new ones.

Overseas Buyers are invited to Britain for the 1947 British Industries Fair. It will enable them to establish personal contact with the makers of the immense range of United Kingdom goods displayed in the London (Lighter Industries) and Birmingham (Hardware & Engineering) Sections of the Fair. The careful grouping of exhibits will assist buyers to compare the products of competing firms with a minimum of time, trouble and expense. Special arrangements to suit individual markets can be discussed and terms and conditions of business settled direct with the manufacturer, since only the actual producer or the sole selling agent may exhibit.

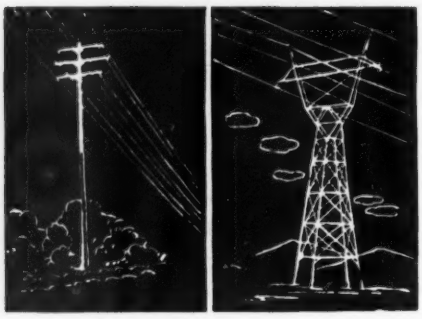
★ *For full details of the* 1947 *Fair apply to the nearest British Commercial Diplomatic Officer or Consular Officer, or the British Trade Commissioner in your area.*

**BRITAIN PRODUCES THE GOODS**

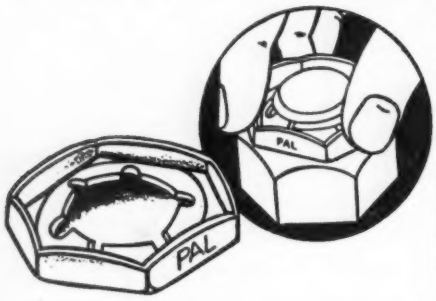
ELECTRICAL EQUIPMENT and ACCESSORIES will be shown in Birmingham

# ELIMINATE RE-TIGHTENING OF NUTS

## *On Steel Tower and Wood Pole Lines*



***Specify Palnuts on new lines***
***Add Palnuts to existing lines***




**For over 10 years, Double Locking Palnuts have been keeping bolt-and-nut assemblies tight on steel towers, wood pole lines, cross arms and braces, insulator pins, clevises and clamps.**

**When applied on new installations, Palnuts save future check-ups and re-tightening. Maintenance crews checking old installations can add Palnuts without disturbing regular nut. Only 3 bolt threads space are required. Palnuts are very low in cost; may be removed and reused. They are available in a full range of sizes, in Hot Dipped Galvanized or other finishes and materials used by the Utility industry.**

**SEND details of your needs for samples. Write for Palnut Manual and detailed folder on power line applications.**

**THE PALNUT COMPANY**
**51 Cordier St.**
**Irvington 11,**
**New Jersey**

**SELF-LOCKING PALNUTS**


## Recent Rate Changes

MISSOURI UTILITIES Co., Cape Girardeau, has been authorized by the state Public Service Commission to reduce its rates $125,000 a year. The cut is retroactive to January 1. The commission retained jurisdiction of the case and its order noted the possibility that a further reduction may be imposed next October if the company's earnings continue to exceed the 6½ percent allowed as a reasonable return.

ROCHESTER GAS & ELECTRIC CORP. has received the permission of the state Public Service Commission to revise electric rate schedules applicable to customers using large amounts of energy, the changes to result in an estimated reduction of $108,000 annually in the bills of such consumers. The revision became effective as of February 25. The company stated in its filing that the revision is part of a long-range program to encourage increased commercial lighting business and new industrial loads.

BUFFALO NIAGARA ELECTRIC CORP. has been granted permission by the state Public Service Commission to revise its electric rate schedules in the Camden, Pulaski and Skaneateles districts. The changes, effective March 3, will result in a reduction of approximately $22,000 a year in the bills of customers in the area affected. More than half of the reduction will accrue to the benefit of residential consumers and the balance of about $9,000 will be scaled from the bills of commercial and industrial users. The present minimum monthly charge in the residential classification is $1 with 12 kw.-hr. allowed in the minimum charge. This will be reduced to 90 cents per month and the amount of energy will be increased to 15 kw.-hr. The Camden, Pulaski and Skaneateles area was formerly served by the Niagara, Lockport & Ontario Power Co., which was consolidated with the Buffalo Niagara Electric Corp.

EDISON LIGHT & POWER CO., York, Pa., citing higher costs of production, has filed a new tariff providing rate increases and changes in existing rates with the Pennsylvania Public Utility Commission. The new rates would become effective after April 18. The new tariff provides a new domestic service rate applicable throughout the company's territory. The old schedule was as follows: 11 kw.-hr., 59 cents; next 19 kw.-hr. at 4 cents per killowatt-hour; next 30 kw.-hr. at 3 cents per kilowatt-hour; next 40 kw.-hr. at 2 cents per kilowatt-hour and over 100 kw.-hr. at 1.5 cents per kilowatt-hour. New rates—10 kw.-hr. 75 cents; next 20 kw.-hr. at 4 cents; next 30 kw.-hr. at 3 cents; next 40 kw.-hr. at 3 cents, and over 100 kw.-hr. at 2 cents.

NEWFOUNDLAND LIGHT & POWER CO., St. Johns, N. F., has announced new rates which are as follows: monthly minimum including 15 kw.-hr., $1.25; 2 cent net for next 200 kw.-hr.; one cent net for excess; commercial, 2 cents per kilowatt-hour; demand charge $2.00 net per kilowatt for first 20 kw.-hr. of maximum demand; $1.50 net per kilowatt for excess.

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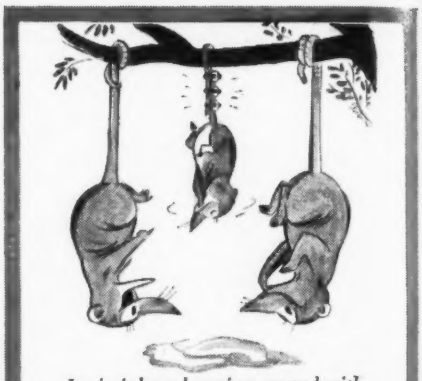
## Will Handle Pump Exports

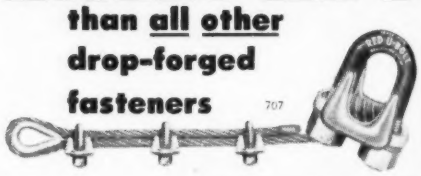
Export activities of the Autopulse Corp. of Detroit, electric fuel pumps, will be handled by the Borg-Warner International Corp.

*Junior's been hanging around with the wrong crowd, Pa . . . so I'm keeping him home with Crosby Clips!*

For guying poles and towers . . . for rigging cranes and derricks . . . for *any* wire rope fastening job . . . use CROSBY CLIPS. Their simple "vise-tight" holding power is safe, permanent and foolproof. Made only by American Hoist and Derrick Company, Saint Paul, Minnesota. Sold by distributors everywhere.

**Industry buys more**
**CROSBY CLIPS**
**than all other drop-forged fasteners**




**For Faster "Pay Out"**
**Simplex REEL JACKS**

Anything on spools, drums or reels can be paid out faster and more safely with Simplex Reel Jacks. Right and left hand bases enable operators to lift in sight of each other for easy jacking. "T" shaped base, with 3 threaded and adjustable tie rods, insures a firm, non-rocking foundation. Ask your supply house for full paticulars, or write for Bulletin U-46.

**Simplex**
LEVER - SCREW - HYDRAULIC
**Jacks**
**TEMPLETON, KENLY & CO.**
1038 South Central Ave., Chicago 44, Ill.

## LETTERS TO THE EDITOR

### More Than A Trickle

*To the Editor of* ELECTRICAL WORLD:

We appreciated your handling of the TVA operations in controlling the January, 1947, flood in the Tennessee Valley in your story in the February 1 issue. We noted one rather regrettable typographical error, which we trust your readers will recognize as such, at the close of the third paragraph where the inflow into the tributary reservoirs was given as 20,000 cubic feet per second instead of 230,000.

Maurice Henle, Chief
Information Service Staff
Tennessee Valley Authority
Knoxville, Tenn.

[To TVA's alert publicity chief, Henle, and other careful readers ELECTRICAL WORLD acknowledges an obvious error—Editor]

•

### Protests Restrictions on Arc Welding

*To the Editor of* ELECTRICAL WORLD:

Anyone following the standards and discussions covering arc welding electrodes and techniques cannot help but wonder. Here is a process that has been used in billions of cases for every imaginable purpose over a generation, whose record has been almost perfect, yet it is criticized and limited more than any comparable process in all mechanical history. The criticism is not because of failure, as there is none. The criticism is entirely in the region of theory covering conditions which could never occur in commercial application.

Anyone who views the situation objectively cannot help but wonder whether the people writing such standards and making such researches can possibly be serious.

There is one controlling fact regarding welded structures which, from a practical point of view, makes all of this activity nonsensical. That fact is this—in the case of mild steel, which embraces more than 95 percent of all the welding which is done, the welded joint is very much stronger and has a very much higher elastic limit than the plates joined.

Since that is true, the weld can never be used in actual service at anywhere near its point of failure. As a matter of fact, in actual application if the welded structure should be loaded to a point which would even approach the elastic limit of the welded joint, or the metal immediately adjacent to the weld,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Wire Connectors
SOLAR
SCRU-ITS
"MR. SCRU-IT" (Trade Mark)

Solar SCRU-ITS are used for connecting two or more wires without tape, solder, flame or tools. They are economical and easy to use—wire ends are stripped and SCRU-ITS screw right on to form a compact and efficient joint.

SCRU-ITS give better mechanical and electrical contact . . . eliminate possibilities of shorts, grounding and corrosion. Their compact size permits their use where working space is at a minimum.

Available in several sizes for connecting various combinations of wires.

EASY TO USE:

1. STRIP WIRE

2. SCREW IT

3. THAT'S IT with SCRU-ITS!

MILLIONS IN USE • HUNDREDS OF APPLICATIONS

"Roughing-in" or permanent wiring is simplified with SCRU-ITS . . . they thread on with a twist of the wrist . . . and the joint is complete!

- Fixtures
- Outlet Boxes
- Fuse Boxes
- Panel Boards
- Switch Boxes
- Lighting Devices
- Conduit Boxes
- Circuit Breakers
- Switch Controls
- Motor Connections

and many others.

U S PATENT NO 1,933,555

DON'T TAPE
DON'T SOLDER
"SCRU-IT"!

• MADE IN FOUR SIZES
• MAY BE USED WITH SOLID OR STRANDED WIRES

Write for Data Sheet A-3

For complete specifications on SCRU-IT sizes, uses, prices, etc., WRITE TODAY.

SOLAR ELECTRIC CORPORATION
FACTORY and SALES OFFICES
WARREN, PENNSYLVANIA

Since 1923

SUPERIOR

SWITCHBOARD & DEVICES CO.

CANTON, OHIO

A Subsidiary of The Union Metal Manufacturing Co.

Quality meter testing and installation equipment

New!!

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"The Inside Story of TRICO RENEWABLE FUSES"

If you use fuses, you'll want this valuable 24-page quick reading, profusely illustrated booklet. It's complete, practical, informative . . . contains a complete explanation of fuse designs and tells how you can . . .

- Stop needless fuse blowings
- Reduce fuse costs
- Stop vicious fuse tampering
- Create current savings
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- Get three times the service from your fuse investment

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MILWAUKEE 12, WISCONSIN

the structure itself would be useless.

Perhaps we can illustrate the matter this way—supposing there is a chain of 100 links, each link being made out of 1-in. round, 99 of these links being made of mild steel and one link made of high strength alloy steel. Then suppose the chain was tested. Would anyone worry about the chain breaking in the one alloy link? He would not, because every one of the other 99 links would break long before the alloy steel link was even partially loaded.

Exactly the same thing is true of a welded structure. The weld itself and the metal immediately adjacent to it has an elastic limit 50 percent above that of the parent metal and has ultimate tensile strength at least 20 percent greater. If the strength of the rest of the structure is sufficient, certainly the weld must be. As a matter of fact, structures are designed with a factor of safety so that at its maximum load the structure would not be up to one-half of the elastic limit of the parent metal. Obviously, it would not be stressed to more than one-third of the elastic limit of the weld metal and the plate immediately adjacent to it. Using our illustration, why do we worry about the alloy steel link when the mild steel chain is not loaded to its yield point?

Because of this program of criticism, great and unnecessary expense is put upon the manufacturer using welding. This, of course, is paid by the buyer in higher prices. No reason nor any possible return accrues to the user. There are countless illustrative cases that could be cited; the following are examples. If there is surface porosity, even so much as one little hole on the surface, the weld is rejected. If that same little hole were below the weld surface where it could not be seen, the manufacturer must cut it out carefully and *re-weld the joint*, at great expense, after finding it with expensive x-ray. Again, if there occurs slight undercutting at the edge of the weld, the weld must be re-welded and the slight undercut eliminated.

Perhaps we could understand such rules if they were not made by engineers who obviously know the facts. However, all such rulings are made by men who insist they are expert in the profession of arc welding. Hence, the conclusions are not based on ignorance.

Engineering has contributed to America's prosperity in an unbelievable way, but I tremble to think what would occur to our prosperity if all engineering were as remiss in its understanding of the problem as is true of many engineers' attitude toward electric welding.

There is no doubt that if the foolish restrictions, which can add nothing whatsoever to the success of any welded joint, were removed, the cost of weld-

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

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ILSCO OPERATES ITS OWN TUBE MILL

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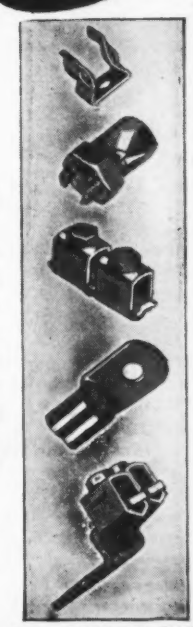
LUGS AND CONNECTORS

*Simplicity*
IN DESIGN AND CONSTRUCTION

FEWER parts, more skillful engineering design and construction, easy, swift installation . . . and copper 99.99% pure . . . 100% conductive . . . just a few reasons why you should "go Ilsco for '47."

*Write for 48-page illustrated catalog.*



ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO


ing those structures could be reduced by as much as 90 percent in many cases; yet because of these restrictions, concurred in by many engineers, the industry paid hundreds of millions of dollars in additional costs over the years with no increase in safety and no betterment of the product from any point of view.

These same restrictions still stand and are being rapidly amplified. There can be no doubt that their presence is not the result of engineering judgment. It is impossible to believe that can be true. There can be only one reason and that is a studied attempt by some people to discredit this tremendously valuable manufacturing process which contributed more to the winning of the war than almost any other recent mechanical development. Such a program must be stopped.

J. F. Lincoln
President
The Lincoln Electric Co.

•

## Dead—But Why

*To the Editor of* ELECTRICAL WORLD:

I am attaching a photograph illustrating a phenomenon which occurred on one of our rural lines in Bienville Parish, Louisiana.

This is a 7,620-volt, grounded neutral line. You will note there are 21 birds

hanging by the claws from the energized conductor. The lower wire is grounded. There is a 30-in. spacing between the two wires. There were also a number of dead birds on the ground.

Many theories have been advanced on the apparent electrocution of these birds and if you care to run the photograph, I would appreciate the comments of your readers.

No fault appeared on the line, and there was no operation of fuses or oil circuit breakers.

A. O. Evans
Division Manager
Louisiana Power & Light Co.
West Monroe, La.

▶ You tell us! We're puzzled too—Editor.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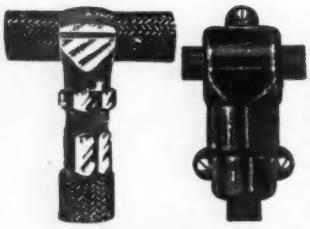

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## BOOK REVIEWS

**The Electronic Engineering Master Index.** By F. A. Petraglia. Published by The MacMillan Co., New York, N. Y. 209 pages. Price $6.

Patterned after the familiar engineering indexes, this one presents some 10,000 references in some 65 American and foreign periodicals. They are largely from the 1935-1945 decade, although there are entries from earlier years. A cross index facilitates locating articles under alternative classifications. The field covers both theory and practical applications.

**Electrical Engineering.** By F. H. Pumphrey. Published by Prentice-Hall, Inc. New York 11, N. Y. 369 pages, illustrated. Price $5.35.

Orientation is toward students in field cognate to the electrical and consequently the first half deals with principles of circuits, machines and systems in simple mathematical manner. Subsequent chapters should familiarize the prospective mechanical or civil engineer with the electronic devices, motors, measurements, controls, and electrochemical operations he is likely to encounter. There is a concluding chapter on telephony and radio.

**Electric Power Equipment.** By J. G. Tarboux. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 491 pages, illustrated. Price $6.

In 14 years the subject matter of the second edition had become noticeably out of line with prevailing practice. In correcting this, compatibly with (senior) textbook limits, the author has minimized the design content (which can usually be found in orthodox textbooks on electrical machinery) for the sake of focus on practical adaptation. Thus the book affords an excellent point of departure for the teacher who keeps abreast of the urgently discussed current problems by maintaining close contact with the literature and the group meetings of the day. There are too few graduates who quickly feel at home in a job that thrusts them into the serious atmosphere of large-scale utility plant operations. This book can dispel some of their timidity and unfamiliarity.

**Principles of Radar.** By M.I.T. Radar School. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 844 pages, illustrated. Price $5.

This is a second edition of the first book on radar as prepared for the Armed Forces school by the Massachusetts Institute of Technology specialists. Changes are partly pedagogical but generally such as to record the advances in the art of timing circuits, pulsers, modulators, synchros and the servomechanisms required by radar sets. The chapters are not highly mathematical and the orthodox electrical engineer who has at least partly "caught up" with electronics should be able to grasp the rudiments and refinements of radar from them.

**The Electronic Control Handbook.** By R. R. Batcher and William Moulic. Published by Caldwell-Clements, Inc., New York, N. Y. 344 pages, illustrated. Price $4.50.

Industrial engineers (and power sales engineers who work with them) have available here a compilation of methods and equipment assemblies appropriate for dealing with the growing control functions of industrial operations and processes. In

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orderly fashion the theory, in terse form, is followed by practical treatment of multifarious applications such as gaging, pressure control, thickness measurements, thermistors, humidity control, amplification characteristics, counting, timing control, stable networks, servomechanisms, relays and motors useful for control setups.

**Practical Electrical Mathematics.** By W. E. Rosch. Published by D. C. Heath & Co., New York, N. Y. 357 pages, illustrated. Price $2.

Written by a trade school instructor, the treatment is addressed to that specific level and confines itself to the simple arithmetical computations associated with resistance, grounding, ampere-turns, cables, circuits, inductance power factor, transformer connections and meters.

**Direct and Alternating Currents.** By E. A. Loew. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 748 pages, illustrated. Price $5.

Emphasis on the fundamentals is preserved in this third edition as established by Dean Loew in the original 1933 edition. New material deals with delta-wye transformations, networks, silicones, regulators, the book dealing with machines as well as circuits.

**Applied Atomic Power.** By E. S. C. Smith, A. H. Fox, R. Tom Sawyer and H. R. Austin. Published by Prentice-Hall, Inc., New York, N. Y. 227 pages, illustrated. Price $4.00.

Two professors and two executive engineers have here traced the history of radioactivity and of atomic fission so that the reader can grasp the origin of atomic energy and its application for power purposes. Avoiding the heavy language of the physicist, all sections are phrased in terms the average engineer can understand. The functions performed at Hanford, Oak Ridge, Los Alamos and the Argonne laboratory are tersely described in preparation for the objective chapters discussing the cycles by which the heat derived from the uranic piles can be utilized in turbines (steam or gas) for electric generation or marine or locomotive propulsion. As a consequence the book affords a lucid picture of the geology, radioactivity, atom-splitting, thermodynamics and mechanics embraced in the task of getting peaceful power from the atom.

**Examination of Industrial Measurements.** By John W. Dudley, Jr. Published by McGraw-Hill Book Co., New York, N. Y. 113 pages, illustrated. Price $2.00.

With minimized resort to mathematics and with ample use of graphs, the author essays to make the collection and interpretation of data serve toward intelligent control of quality. Explanation of randomness, deviation, dispersion, quartiles, probability, median fitting to curves and skewness is aimed at increasing the familiarity and facility of the industrial engineer with the methods of the statistician. Examples are given to show how the procedure can be applied and how tractable data can be distinguished from erratic and futile data.

**Engineering Radiography.** Published by Emmott & Co., Ltd., Manchester, England. 57 pages, illustrated. Price 2 s. 6 d.

Technique of X-ray examination in industrial plants appears here in compact but comprehensive and quantitative form. Basic practice data is from A.S.M.E. and National Bureau of Standards. Other chapters treat use of gamma rays and radium as well as crystal analysis.

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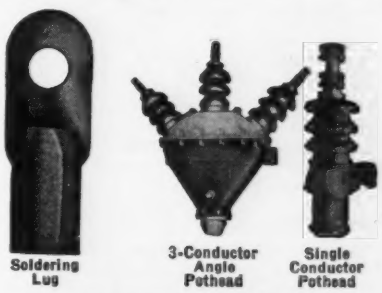


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